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ABSTRACT

This document contains materials developed for and about the environmental technology tech prep program of the South-Western City Schools in Ohio. Part 1 begins with a map of the program, which begins with an environmental science technology program in grades 11 and 12 that leads to entry-level employment or a 2-year environmental technology program at a community college that in turn leads to a technical career or transfer to a four-year college or university. Also included in part 1 are the high school curriculum pathways and pathway narratives. Part 2, which constitutes approximately 90% of the document, lists the program's (unleveled) secondary technical and academic competencies. In part 3, the secondary competencies are leveled for a high school. Parts 4-7 contain the following: postsecondary competencies; labor market data; list of advisory/review committee members; and program application (information on employment opportunities in the area, potential exit occupations for the program, and plans for the program's delivery). The following are among the categories of competencies included: environmental management and resource conservation; local and global natural resources; industrial pollution control; environmental project coordination; environmental assessment; biological surveying and monitoring; the scientific method; and research methodology. (MN)

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ED 414 456

HEART of OHIO TECH PREP CONSORTIUM

Environmental Technology

Revised & Approved, Consortium Board of Directors, 1997

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- Secondary & Postsecondary Curriculum Pathways & Narratives
- Secondary Academic Competencies - Unleveled
- Secondary Competencies - Leveled per School
- Postsecondary Competencies
- Labor Market Data
- Advisory/Review Committee Members
- Program Application

CE075375

Heart of Ohio Tech Prep Consortium

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Environmental Technology

Heart of Ohio Tech Prep Consortium
Revised & Approved 1997, Consortium Board of Directors

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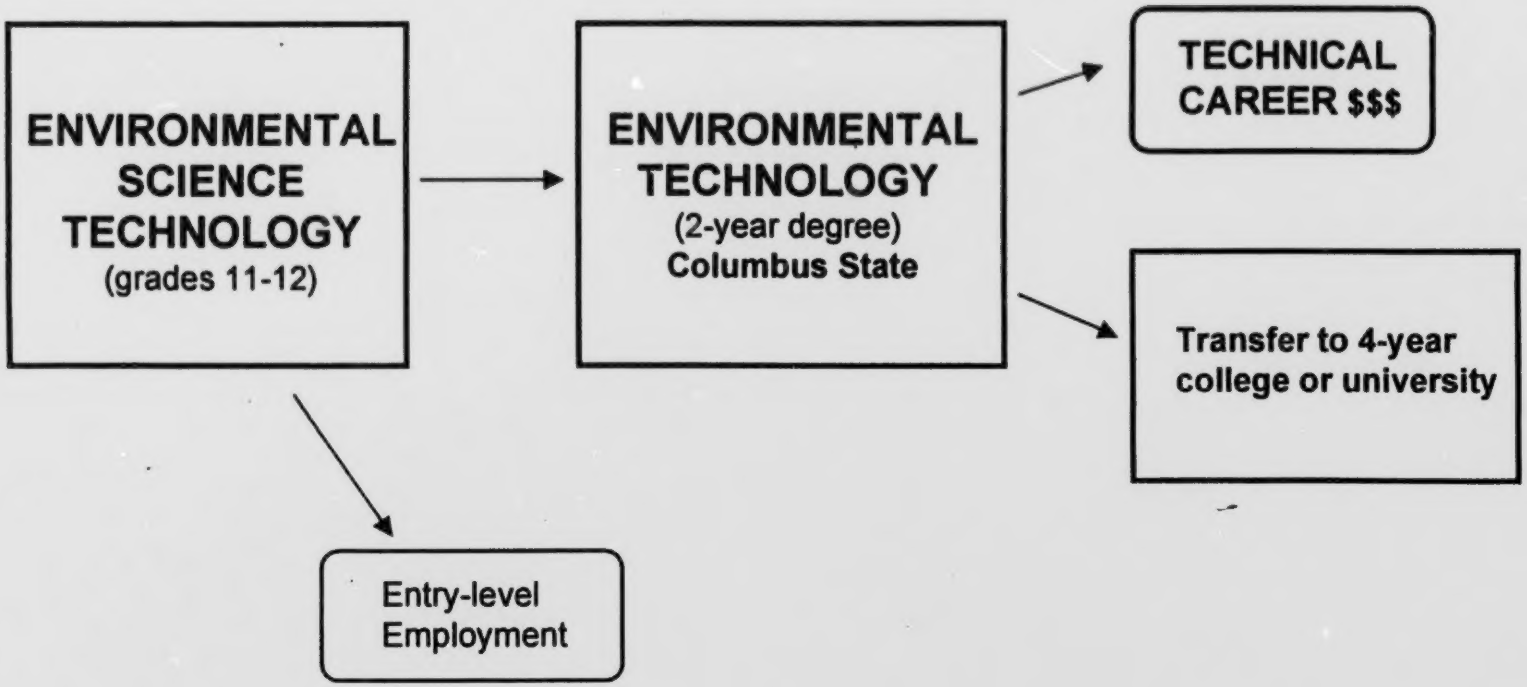
Heart of Ohio Tech Prep Consortium

MAP of ENVIRONMENTAL SCIENCE TECHNOLOGY Tech Prep Program (12/97)



ENVIRONMENTAL SCIENCE TECHNOLOGY
(grades 11-12)

ENVIRONMENTAL TECHNOLOGY
(2-year degree)
Columbus State

TECHNICAL CAREER $$$

Transfer to 4-year college or university

Entry-level Employment

HEART of OHIO TECH PREP CONSORTIUM

1997

Environmental Technology Model

PART I.A:
Secondary Curriculum Pathways and Narratives

Reynoldsburg High School &
Eastland VEPD

September 1995

Environmental Management Technology

Central Ohio Tech Prep Consortium

9th Grade	Min	10th Grade	Min	11th Grade	Min	12th Grade	Min
Tech or Business Algebra I		Tech or Business Geometry		College English III	48	Integrated Math IV	48
American History		Resource Management	150	Integrated Math III	48	College English IV	48
Applied Biology		Mechanical Science/		Enviro Chemistry	48	Enviro Geology	50
Word Processing	50	Adv Word Process/Computers	50	Tech Prep Lab	150	*Tech Prep Lab	100

PREREQUISITES FOR GRADE 11 OF TECH PREP:
Demonstrated potential for college preparation coursework as measured by standardized achievement test:
- No academic deficiencies
- Successful completion of Alg I

PREREQUISITES FOR COLLEGE PORTION OF TECH PREP:
Enrollment in 9th and 10th grade Tech Prep academic course work or college preparatory course work. Articulation or proficiency testing will determine where students place into the program.

SUGGESTED ELECTIVES:
Foreign Language (Grades 9 & 10)
Computer Literacy (Grades 9 & 10)
Biology I

EXPLANATION OF TECH PREP BLOCKS:
9th Grade: Students are in a 200-minute block of core curriculum.
10th Grade: Students are in a 150-minute block of core curriculum.
11th Grade: Tech Prep science (chemistry) and occupational competencies taught in 198 minute block.
12th Grade: Tech Prep Science (Geology) and occupational competencies taught in 150 minute block.
***12th Grade:** Occupational competencies developed through participation in school-based learning; worksite-based internships, mentorships; and/or enrollment in post-secondary options.

HIGH SCHOOL EXIT OCCUPATIONS:
Wastewater Treatment Plant Operator, Environmental Lab Technician, Water Treatment Plant Operator, Natural Resources Aide, Pollution Control Technician

COLLEGE EXIT OCCUPATIONS:
Hazardous Waste Technician, Emergency Response Technician, Environmental Technician, Research Technician, Air Sampling and Monitoring Technician

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Central Ohio Tech Prep Consortium
Curriculum Pathway Narrative
Reynoldsburg High School
April 1996

Directions: Please complete this document to accompany the curriculum pathways

In the space below, briefly describe the systemic change at the secondary level and what new options are now available for Tech Prep high school students (occupational, employability, and academic).

Systematic change at Reynoldsburg High School is reflected in the integration of personal development and resource management classes, mentorship, and core curriculum classes in a team setting.

Change is also reflected in the eleventh and twelfth grade plan in which students will have the option of attending the high school Tech Prep program of their choice for one-half or full-day, attending the career center for the occupational portion of the program.

In the ninth grade, the Reynoldsburg High School Tech Prep plan combines six subjects (math, science, American history, communications, word processing, applications, and personal development) taught by a team of six teachers. The four core subjects will be delivered in a 200-minute block in the morning. Word Processing Applications and Personal Development, which are normal semester classes, will be offered in the afternoon following lunch on an alternating-day basis determined by which group the student is in — purple or gold. For example, period six purple would go to Word Processing Applications on Monday while period six gold would go to Personal Development. On Tuesday, the groups would switch classes, etc. All students receive 5 1/4 credits that include one math, one communications, one science, one American history, one-half word processing elective, and 3/4 personal development elective. Through the Personal Development class, students will have the opportunity to do job shadowing. The students also have two periods for electives or other freshman required courses in the afternoon. Projects will be introduced approximately once a month and will be "led by one of the six team subjects. Each project will integrate from two to all six classes. One hundred eight ninth-grade students have selected the Tech Prep plan.

In the tenth-grade year, students have an opportunity to continue their Tech Prep studies in a 100-150-minute morning block of classes taught by a team of teachers. These classes include communications for one credit, math for one credit, computer applications for one-half credit, and resource management for 3/4 credit and are job focused. Again, computer applications and resource management meet on an alternating day basis. In the resource management class, students will study the process of finding a job, go through mock interviews, and will study how to budget their resources to enhance their personal life. Following lunch, students have the opportunity to take up to four electives or other sophomore required classes. Thematic projects will be introduced once every nine weeks.

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Whiteh Yearling High School &
Eastland EPD

Environmental Management chnology

Central Ohio Tech Prep Consortium

September 1995

9th Grade	Min	10th Grade	Min	11th Grade	Min	12th Grade	Min
Tech or Business Algebra I	200	Tech or Business Geometry	150	College English III	48	Integrated Math IV	48
American History		Resource Management		Integrated Math III	48	College English IV	48
Personal Development	50	Tech Biology		Enviro Chemistry	48	Enviro Geology	50
Word Processing	50	Adv Word Process/Computers	50	Tech Prep Lab	150	*Tech Prep Lab	100

PREREQUISITES FOR GRADE 11 OF TECH PREP:
Demonstrated potential for college preparatory coursework as measured by standardized achievement test:

- No academic deficiencies
- Successful completion of Alg I

PREREQUISITES FOR COLLEGE PORTION OF TECH PREP:
Enrollment in 9th and 10th grade Tech Prep academic course work or college preparatory course work. Articulation or proficiency testing will determine where students place into the program.

SUGGESTED ELECTIVES:
Foreign Language (Grades 9 & 10)
Computer Literacy (Grades 9 & 10)
Biology I

EXPLANATION OF TECH PREP BLOCKS:
9th Grade: Students are in a 200-minute block of core curriculum.
10th Grade: Students are in a 150-minute block of core curriculum.
11th Grade: Tech Prep science (chemistry) and occupational competencies taught in 198-minute block.
12th Grade: Tech Prep Science (Geology) and occupational competencies taught in 150-minute block.
***12th Grade:** Occupational competencies developed through participation in school-based learning; worksite-based internships, mentorships; and/or enrollment in postsecondary options.

HIGH SCHOOL EXIT OCCUPATIONS:
Wastewater Treatment Plant Operator, Environmental Lab Technician, Water Treatment Plant Operator, Natural Resources Aide, Pollution Control Technician

COLLEGE EXIT OCCUPATIONS:
Hazardous Waste Technician, Emergency Response Technician, Environmental Technician, Research Technician, Air Sampling and Monitoring Technician

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Central Ohio Tech Prep Consortium
Curriculum Pathway Narrative
Whitehall-Yearling High School
April 1996

Directions: Please complete this document to accompany the curriculum pathways.

In the space below, briefly describe the systemic change at the secondary level and what new options are now available for Tech Prep high school students (occupational, employability, and academic).

Whitehall-Yearling High School has chosen to create its own model of excellence using The Effective Schools Model as a springboard. A vast majority of our students graduate from the "general track" with no specific employability skills. Therefore, we are initiating Tech Prep, an interdisciplinary, project-oriented approach to learning, which will more effectively prepare graduates to enter the work force, college, or other postsecondary educational opportunities.

The Whitehall-Yearling Plan, during the ninth-grade block, will combine five subjects (communications, math, science, business, and technology) in a four-period time block. The block will be 214 minutes long and will be delivered in the first four periods of the day. Students will travel from the different rooms based on time schedules to be determined by the team of teachers. All students will receive four credits that include: 1 math, 1 communication, 1 science, ½ business, and ½ technology. These students will then have a lunch period, followed by three additional periods for electives or other required courses. During the Tech Prep program, each project will focus on a different academic area. One hundred ninth-grade students have been selected for the Tech Prep team.

The tenth grade block, consisting of communications, science, math, and computer applications, will enable students to continue their Tech Prep studies. That team of teachers will be selected before school is adjourned in June 1994. The tenth grade Tech Prep program will be based on four thematic units. At the junior and senior levels, students will be instructed by vocational instructors at the home school, at the career centers, or on the job. Career clusters and applied academics are currently being developed in engineering and technology. This constitutes our view of a seamless curriculum whereby students will graduate prepared to enter two-year, technical, or four-year postsecondary programs, or the world of work. We feel the Whitehall-Yearling Plan addressed the precepts of the common belief system as follows:

ALL STUDENTS CAN LEARN: The Whitehall-Yearling Plan addresses the needs of all students, especially those who learn best in a nontraditional environment. The removal of barriers posed by the traditional, 50 minute academic block will allow students to become more participatory in their learning. Students will see connections between academia and the world of work. Project-based learning will ensure applied academics and hands-on experiences. This plan will also more effectively allow for mainstreaming and inclusion of special needs students. Teachers will be seen and heard making decisions and discussing various strategies to enhance student success.

LEARNERS POSSESS MULTIPLE INTELLIGENCES: The Whitehall-Yearling Plan will be built upon the students' individual talents and strengths such as music, photography, speech, etc., to complete unit projects. In addition, a learning styles assessment, known as CAPSOL, will be administered during the summer of 1994, after which teachers can more effectively create classrooms and activities which take into account various learning styles. At the junior/senior levels, students will be able to participate in career clusters which most appropriately match their individual aptitudes and interests. Teachers will be observed using five to seven instructional strategies during a unit of study.

PARTICIPATION IN A LEARNING COMMUNITY FOSTERS SOCIAL, CIVIC, EMOTIONAL, AND INTELLECTUAL GROWTH: Teachers working in interdisciplinary teams will help students see the connections between academic disciplines. The use of more hands-on projects, especially the culminating activities, will encourage students to learn to work and problem-solve in teams. Weekly Tech Prep assemblies of students and teachers will be held to increase communication. The Tech Prep team has already begun referring to the success of "our" kids for the next year. Community members, parents, and business partners will be involved in the assessment of those projects. As the students move into the tenth grade Tech Prep program, shadowing experiences, interest inventories, interning, use of the OCIS, review

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of the ICP, and exploration of the career clusters at off-site locations such as Mt. Carmel East Hospital, Columbus State Community College, AT&T, Limited Credit Services, EBCO, and the C. Ray Williams Early Child Development Center.

DIVERSE INSTRUCTIONAL STRATEGIES AND ENVIRONMENTS: The school day will certainly be different for the Tech Prep student. Class time will be based on learning needs rather than on the clock. Tech Prep teachers have already been given common planning time as well as an individual planning period. Alternative assessments, such as portfolios, learning logs, and audio-visual projects will be used in conjunction with community assessors and displayed throughout the school. The SCANS report has been utilized to determine competencies needed in modern occupations and will be studied by students in applied classes.

SUPPORT SYSTEMS: Whitehall is fortunate to have acquired five computer labs for student use which will be an integral part of The Whitehall-Yearling Plan as the students learn keyboarding, editing, and desktop publishing skills. The Board of Education has allowed the high school to eliminate the general track and has encouraged our pursuit of the Tech Prep initiative. The BRIDGES grant, acquired in 1990, has since been incorporated into the district budget, providing peer-assisted learning tutors. Whitehall is also fortunate to have a broad base of support from local corporations and small businesses, led by its education partner, Limited Credit Services. Within a five-mile radius, lie Mt. Carmel East Hospital, AT&T, EBCO, DCSC, DFAS, and Port Columbus.

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Eastla /EPD

Environmental Management T ology
Satellite Program at New Albany High School

Central Ohio Tech Prep Consortium

September 1995

9th Grade	Min	10th Grade	Min	11th Grade	Min	12th Grade	Min
				College English III	48	College English IV	
				Enviro Chemistry	48	Integrated Math IV	48
				Integrated Math III	48	Enviro Geology	50
				Tech Prep Lab	150	*Tech Prep Lab	100

PREREQUISITES FOR GRADE 11 OF TECH PREP:
Demonstrated potential for college preparatory course work as measured by standardized achievement test:

- No academic deficiencies
- Successful completion of Alg I

PREREQUISITES FOR COLLEGE PORTION OF TECH PREP:
Enrollment in 9th and 10th grade Tech Prep academic course work or college preparatory course work. Articulation or proficiency testing will determine where students place into the program.

SUGGESTED ELECTIVES:
Foreign Language (Grades 9 & 10)
Computer Literacy (Grades 9 & 10)
Biology I

EXPLANATION OF TECH PREP BLOCKS:
11th Grade: Tech Prep science (chemistry) and occupational competencies taught in 198-minute block.
12th Grade: Tech Prep Science (Geology) and occupational competencies taught in 150-minute block.
***12th Grade:** Occupational competencies developed through participation in school-based learning; worksite-based internships, mentorships; and/or enrollment in postsecondary options.
Employability skills are taught within the technology lab.

HIGH SCHOOL EXIT OCCUPATIONS:
Wastewater Treatment Plant Operator, Environmental Lab Technician, Water Treatment Plant Operator, Natural Resources Aide, Pollution Control Technician

COLLEGE EXIT OCCUPATIONS:
Hazardous Waste Technician, Emergency Response Technician, Environmental Technician, Research Technician, Air Sampling and Monitoring Technician

Central Ohio Tech Prep Consortium
Curriculum Pathway Narrative
Eastland Vocational School District

Directions: Please complete this document to accompany the curriculum pathways.

In the space below, describe system change at the secondary level and what new options are now available for Tech Prep high school students (occupational, employability, and academic).

Systemic changes are reflected in the satellited Environmental Management Technology program schedule where students have the option of attending New Albany High School for a full day or attending their home school for the academic portion of the program and spending a half day at the New Albany High School for the occupational portion of the program.

The primary focus of the Eastland Environmental Management Technology program is to prepare students for continued study in two-year or four-year colleges after high school graduation. While meeting this goal, the program also prepares the student for an entry-level position in several environmental fields.

Approximately one-half of the day is spent in academic classes. Instructors in chemistry, geology, and algebra, work closely with the program instructor to relàte college-preparatory academic course work to the environmental industry. Although course work is not applied, all students are required to enroll in a college preparatory English class for both the junior and senior year of the program.

The other half-day involves textbook and hands-on learning connected to various aspects of the environment. The occupational competencies will be delivered in the 100 - 150-minute Environmental Management lab. Flexible block scheduling allows the Environmental Management Technology; the algebra and science instructors to work with the same group of students. This scheduling provides the flexibility for teachers to develop interdisciplinary units, to team teach, and to adjust periods allowing more instructional time for specific topics.

In addition to daily contact with the Environmental Management Technology instructor, students will receive instruction from other instructors associated with the Environmental Technology program offered at Columbus State Community College. Numerous opportunities will be available for off-site learning experiences at Columbus State, Ohio State and environmentally-related industries in the area. Students also have access to a 50-acre wetlands/woodlands on a daily basis.

During the senior year of the program, occupational competencies are developed through participation in school-based learning; worksite-based internships, mentorships; and/or enrollment in post-secondary options.

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1997

Environmental Technology Model

PART I.B:
Postsecondary Curriculum Pathways & Narratives

Columbus State Community College

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Environmental Technology, Columbus State Community College
April, 1997, Post Secondary Path-The Heart of Ohio Tech Prep Consortium

1st Quarter	Cr	2nd Quarter	Cr	3rd Quarter	Cr	4th Quarter	Cr	5th Quarter	Cr	6th Quarter	Cr
Beg. Composition ENGL101 G	3	Essay & Research ENGL102 G	3	Elementary Chemistry I CHEM111 B	5	Elementary Statistics MATH135 B	5	Environmental Chemistry ENVR220 T	3	Technical Elective XXX T	2
Technical Math II MATH112 B	4	~~Industrial Pollution Control~~ ENVR110 T	3	Basic Surveying SURV141 T	4	Environmental Systems Analysis ENVR253 T	3	Elementary Hydraulics CIVL221 T	3	Subsurface Restoration Techniques ENVR254 T	5
Environmental ~~Project Coord.~~ ENVR101 T	3	Introductory Biology I BIO 111 B	5	Environmental Aspects of Soil ENVR120 T	3	Technical Writing ENGL204 G	3	World Economic Geography SSCI104 G	5	American Civilization II HUM152 G	5
Earth Systems I GEOL101 B	5	Environmental Laws & Regulations ENVR130 T	5	Environmental Science BIO 127 B	5	Subsurface Invest. Techniques ENVR250 T	5	Air Monitoring ENVR255 T	4	Environmental Hydrology ENVR224 T	3
Environmental Analysis ENVR158 T	3	Conference & Group Discussion COMM110 G	3	Health & Safety ~~Training/Haz. Waste~~ ENVR252 T	3	Wastewater Treatment Techniques ENVR223 T	3	Environmental Computer Appl. ENVR112 T	3	Cardiopulmonary Resucitation MULT102 T	1
Basic Construction Drafting ARCH111 T	4							Construction CAD Drafting ARCH112 T	3	Responding to Emergencies MULT103 T	2
										Hazardous Materials Refresher ENVR256 T	1
										Water Treatment Techniques ENVR222 T	3

Strikeout text = those courses that students may articulate or pass via proficiency testing
Shaded boxes = advanced skills added to the curriculum

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High School Exit Occupations:

Wastewater Plant Operator
Environmental Lab Technician
Water Plant Operator
Natural Resources Aid
Pollution Control Technician

College Exit Occupations:

Air Sampling and Monitoring Technician
Field Sampling Technician
Environmental Technician
Wastewater Analyst
Water Analyst
Soil Analyst
Hazardous Materials Analyst
Chem/Analytical Lab Technician
Biological/Microbiological Lab Technician
Environmental Compliance Technician
Lead-Based Paint Abatement Worker/ Supervisor/Inspector
Asbestos Abatement Worker/Supervisor/Inspector
Decontamination Technician
Emergency Spill Response Technician
Leaking Underground Storage Tank Remover
Haz Mat Technician
Wastewater Plant Operator
Water Plant Operator

Prerequisites for College Portion of Tech Prep:

No specific prerequisites because articulation or proficiency testing will determine where students will enter the program. However, in order to follow the sequence as closely as possible, students should be computer literate and proficient in beginning algebra. High school level chemistry and biology coursework is recommended, as well.

Suggested Electives:

Field Co-op Experience, Work Experience Seminar, and Manufacturing Processes.

Advanced Skills Portion of Tech Prep:

Shaded areas represent the advanced skills portion.

Central Ohio Tech Prep Consortium
Curriculum Pathway Narrative

Columbus State Community College Environmental Technology
April 1997

In the space below, describe the systemic change at the postsecondary level and what new options will be available for Tech-Prep college students (occupational, employability, and academic).

Systemic change that will occur in the Environmental Technology at Columbus State, as a result of the installation of Tech Prep pathways in the Heart of Ohio Tech Prep Consortium, include the following:

- Additional breadth and depth competencies will be possible at the post-secondary level as a result of students coming to Columbus State better prepared to do college level work. This will help ensure that business and industry's expectations for qualified Environmental professionals are being met by increasing the time available to learn additional competencies that are being requested by employers in the following areas:

  * Drafting/CAD
  * Experience credit toward Wastewater Treatment Plant Operator's License
  * Experience credit toward Water Treatment Plant Operator's License
  * Current HAZWOPER Certification

- Business and industry are seeking graduates that are broadly educated across disciplines as well as prepared specifically in technical specialties related to their primary field. The Heart of Ohio Consortium approach addresses these needs on a program-by-program articulation basis. This optimizes the ability of graduates to be immediately productive and job ready upon graduation from the Columbus State Community College associate degree program. Graduates from these advanced skills programs should enhance the employers' competitive ability in a period of rapid technological change.

  Articulation agreements between specific VEPD Tech Prep programs and the Columbus State Community College Environmental Technology program will be formalized on an individual basis, as the vocational articulation agreements are currently done. The Tech Prep agreements will be in addition to, not in lieu of, existing vocational program agreements.

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Explanation of Tech Prep Course Differences:

Struckout courses represent those that students may articulate or pass via proficiency testing. Shaded courses represent the advanced skills protion. The current technical program is represented by 106 credit hours.

- The Environmental Technology program is regularly validated through ongoing business and industry surveys. While the College is confident that the Environmental Technology program currently meets business and industry needs, the faculty and administration of Columbus State acknowledge that some foundational competencies can be delivered within a collaboratively developed secondary curriculum. The development of this Tech Prep curriculum provides students with a unique opportunity to augment a solid associate degree curriculum with valuable courses and educational experiences that are not currently included in the standard degree program. Students will benefit from the additional depth and breadth of the advanced skills associate degree program as well as the elimination of the need for remediation upon entering Columbus State Community College.

HEART of OHIO TECH PREP CONSORTIUM

1997

Environmental Technology Model

PART II.A:
Secondary Technical Competencies (Unleveled)

COMMUNICATIONS LITERACY

(Eng 100)

Effective Reading Skills

1.01.01.00 Differentiate between fact, opinion, and inference

1.01.03.00 Recognize the intent and use of propaganda

1.01.04.00 Identify and summarize ideas, information, and events that are explicitly stated in written material

1.01.05.00 Explain the sequence of time, places, events, and ideas

1.01.06.00 Identify and explain the main and subordinate ideas (stated or implied) in a written work

1.01.06.01 Differentiate between details that support or do not support main ideas in a written work

1.01.08.00 Find, understand, and apply information from a variety of sources (books, manuals, newspapers, periodicals, directories, reference works, computer printouts, and electronic sources)

1.01.09.00 Use the features of books and reference materials, such as table of contents, preface, introduction, titles and subtitles, index, glossary, appendix, and bibliography

1.01.10.00 Define and use unfamiliar words and specialized vocabulary (including abbreviations, acronyms, concepts, and jargon) by using structural analysis, decoding, contextual cues, dictionaries, and computers

1.01.11.00 Read and understand short notes, memos, letters, and forms

1.01.12.00 Read and follow complex directions

1.01.13.00 Determine the author's purpose

1.01.14.00 Read, evaluate, and respond critically to various literature forms, genres, and printed medias

1.01.15.00 Recognize and interpret organizational patterns of writing (e.g., cause and effect, comparison and contrast, and simple listing)

1.01.16.00 Identify the structural elements of literature (e.g., plot, theme, character, mood, setting, and point of view)

1.01.17.00 Identify literary devices (e.g., metaphor, foreshadowing, flashback, allusion, satire, and irony)

1.01.19.00 Take accurate notes from written sources

1.01.20.00 Recognize, analyze, and discuss the rhetorical strategies and writing techniques used in

1.01.20.00 Recognize, analyze, and discuss the rhetorical strategies and writing techniques used in various student and professional writings

1.01.21.00 Summarize or paraphrase a written selection to confirm one's own understanding of what was read

1.01.22.00 Understand and use appropriate techniques for taking different types of tests

Effective Speaking and Presentation Skills

1.02.01.00 Give oral directions and clear explanations

1.02.02.00 Participate critically and constructively in the exchange of ideas, particularly during class discussions and conferences with individuals

1.02.03.00 Demonstrate correct usage of vocabulary

1.02.05.00 Speak effectively using non-verbal communication such as eye contact, posture, and gestures

1.02.06.00 Select topics suitable to audience, situation, and purpose

1.02.08.00 Give formal and informal talks and speeches

1.02.08.01 Explain and demonstrate the basic elements of public speaking

1.02.08.02 Present speeches using an extemporaneous delivery style, with minimal use of note cards or text, maximum eye contact, appropriate voice intonations and body language, and minimal verbal mannerisms

1.02.09.00 Demonstrate the differences between informing and persuading and use the appropriate techniques of content and delivery for each purpose

1.02.09.01 Present an informative speech by limiting the scope of the topic and selecting a workable pattern of organization with an effective beginning and ending

1.02.09.02 Present a persuasive speech that will demonstrate the student's awareness of and sensitivity to the audience through the use of appropriate language and audience data

1.02.10.00 Use visual media

1.02.11.00 Demonstrate proper telephone etiquette

Effective Writing Skills

1.03.01.00 Demonstrate ability to use different forms of writing (e.g., literary response, business and technical communicative modes, personal responses, journals, research and recording)

1.03.01.01 Demonstrate understanding of good letter writing principles

1.03.02.00 Demonstrate appropriate selection of mode, purpose, audience, point of view, and organization of information in written assignments

1.03.02.01 Produce a completed narrative essay

1.03.02.02 Produce a completed descriptive/observational essay

1.03.02.03 Produce a completed informational paper

1.03.02.04 Produce a completed persuasive essay

1.03.03.00 Demonstrate proficiency in word processing, graphics, and/or desktop publishing aids for writing

1.03.04.00 Apply writing process techniques: 1) Prewriting 2) Drafting 3) Revising 4) Editing/proofreading 5) Publishing

1.03.04.01 Use journal writing as a pre-writing and learning tool

1.03.04.02 Revise and accurately edit both their own and other's written work

1.03.07.00 Create written summaries of information

1.03.08.00 Use appropriate techniques for documentation of sources

Effective Listening Skills

1.04.01.00 Follow spoken directions

1.04.02.00 Distinguish between fact and opinion

1.04.03.00 Make inferences and draw conclusions from verbal and non-verbal messages

1.04.04.00 Identify and comprehend the main and subordinate ideas in lecture and discussions, questions to clarify information heard, and report accurately what others have said

1.04.05.00 Restate or paraphrase a conversation to confirm one's own understanding of what was said

1.04.06.00 Take accurate notes which summarize material presented from spoken

1.04.08.00 Critique speeches and other verbal presentations

Critical Viewing/Graphic/bservation Skills

1.05.01.00 Read and understand graphs, charts, and tables to obtain factual information

1.05.0.00 Produce and utilize effective communication skills in the development of graphs, tables, and charts to communicate ideas

1.05.03.00 Critically view historical or contemporary events, via TV or video tape, and make appropriate observations

1.05.05.00 Communicate through use of video tape and computer presentations

MATHEMATICS

(Math 104)

Algebra

3.01.01.00	Solve linear equations
3.01.01.01	Combine like terms
3.01.01.02	Use the Distributive Property to remove grouping symbols and the Addition/Subtraction Property to combine like terms to simplify expressions
3.01.01.03	Solve equations in one variable utilizing one operation
3.01.01.04	Solve equations in one variable utilizing two or more operations
3.01.01.05	Describe and use the logic of equivalence in working with equations, inequalities, and functions
3.01.01.06	Identify variables, constants, terms, expressions, and coefficients
3.01.01.07	Define absolute value
3.01.01.08	Evaluate algebraic expressions
3.01.01.09	Solve the literal equation or formula for a specified variable
3.01.01.10	Recognize the properties of equalities
3.01.01.11	Solve a 2x2 system of linear equations by elimination
3.01.01.12	Solve a 2x2 system of linear equations by substitution
3.01.01.13	Apply the rules for solving linear equations in one variable
3.01.01.14	Use formulas
3.01.01.15	Use handheld graphic calculators to solve linear equations and graph simple functions
3.01.01.16	Solve linear equations in one variable containing an absolute value symbol
3.01.02.00	Use properties of exponents
3.01.02.01	Define exponent
3.01.02.02	Compare and compute using scientific notation
3.01.02.03	Determine values for the square root of any natural number
3.01.02.04	Determine the principal square root and recognize square roots of negatives as being non-

	real
3.01.02.05	Divide terms having factors with exponents
3.01.02.06	Multiply and divide polynomial expressions
3.01.02.07	Operate with radicals and leave the result in simplified form
3.01.02.08	Apply the properties of exponents to simplify polynomial expressions
3.01.02.09	Multiply terms having factors with exponents
3.01.02.10	Solve radical equations
3.01.03.00	**Factor a polynomial of two or more terms**
3.01.03.01	Apply the distributive law in removing common factors
3.01.03.02	Factor difference of two squares
3.01.03.03	Factor quadratic trinomials
3.01.04.00	**Solve linear inequalities and show the solution on a number line**
3.01.04.01	Combine like terms
3.01.04.02	Use the Substitution Property to evaluate expressions and formulas
3.01.04.03	Evaluate algebraic expressions
3.01.04.04	Use the Distributive Property to remove grouping symbols and the Addition/Subtraction Property to combine like terms to simplify expressions
3.01.04.05	Identify variables, constants, terms, expressions, and coefficients
3.01.04.06	Solve equations in one variable utilizing two or more operations
3.01.04.07	Describe and use the logic of equivalence in working with equations, inequalities, and functions
3.01.04.08	Solve a linear inequality in one variable using two or more operations
3.01.04.09	Define absolute value
3.01.04.10	Solve problems involving statements of inequality
3.01.04.11	Use interval notation to describe inequalities on a number line
3.01.04.12	Define and describe the union and intersection of intervals

3.01.04.13	Graph inequalities in two variables
3.01.05.00	**Recognize, relate, and use the equivalent ideas of zeros of a function, roots of an equation, and solutions of an equation in terms of graphical and symbolic representations**
3.01.05.01	Apply the distributive law in removing common factors
3.01.05.02	Factor the difference of two squares
3.01.05.03	Factor quadratic trinomials
3.01.05.04	Combine like terms
3.01.05.05	Use the Distributive Property to remove grouping symbols and the Addition/Subtraction Property to combine like terms to simplify expressions
3.01.05.06	Solve equation in one variable utilizing one operation
3.01.05.07	Solve equations in one variable utilizing two or more operations
3.01.05.08	Describe and use the logic of equivalence in working with equations, inequalities, and functions
3.01.05.09	Identify variables, constants, terms, expressions, and coefficients
3.01.05.10	Explore and describe characterizing features of functions
3.01.05.11	Find X and Y intercepts of a line
3.01.05.12	Decide whether or not a relation is a function. Use function notation. Find domains and ranges
3.01.05.13	Use set notation to describe and discuss domain and range of a function
3.01.05.14	Factor perfect square trinomials
3.01.06.00	**Graph equations**
3.01.06.01	Develop graphical techniques of solution for problem situations involving functions
3.01.06.02	Explore and describe characterizing features of functions
3.01.06.03	Describe problem situations by using and relating numerical, symbolic, and graphical representations
3.01.06.04	Use the language and notation of functions in symbolic and graphing settings
3.01.06.05	Find X and Y intercepts of a line
3.01.06.06	Write equations for a line

3.01.06.07 Use a graphing calculator or computer to generate the graph of a function

3.01.06.08 Graph a linear equation using the slope-intercept method

3.01.06.09 Translate among tables, algebraic expressions, and graphs of functions

3.01.06.10 Estimate shape of graphs of various functions and algebraic expressions

3.01.06.11 Use handheld graphic calculators to solve linear equations and graph simple functions

3.01.06.12 Graph basic functions using the Cartesian coordinate system

3.01.06.13 Derive the equation of a line given two points of the line, one point and the slope, or slope and Y intercept

3.01.07.00 Demonstrate the ability to translate statements and equations from written to algebraic form and algebraic to written form

3.01.08.00 Determine slope, midpoint, and distance

3.01.08.01 Solve problems related to sets of points on a Cartesian coordinate system

3.01.08.02 Calculate the slope of a line using the coordinates of two points of the line or a graph of the line

3.01.09.00 Model real-world phenomena with polynomial and exponential functions

3.01.09.01 Use curve fitting to predict from data

3.01.09.02 Graph exponential functions which model real world statistics (e.g., population growth, radioactive decay)

Geometry

3.02.01.00 Find perimeters, surface areas and volumes of geometric figures

3.02.01.01 Recognize and classify two-and three-dimensional figures (e.g., circles, triangles, rectangles, cylinders, prism)

3.02.01.02 Create and interpret drawings of three-dimensional objects

3.02.01.03 Classify, label, and describe polygons and solids

3.02.01.05 Use handheld graphic calculators to solve area and volume problems

3.02.01.06 Given the dimensions of various geometric shapes common to the technological industries, determine areas and volumes in English and metric units

3.02.01.07 Estimate the area of irregular plane figures

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3.02.01.09	Convert between radians and degrees
3.02.03.00	**Recognize, classify, and use properties of lines and angles**
3.02.03.01	Demonstrate an understanding of angles and parallel and perpendicular lines
3.02.03.02	Define terms related to angles
3.02.03.04	Demonstrate an understanding of special angles
3.02.03.05	Understand the various units of measure of angles
3.02.03.06	Identify points, lines, and planes
3.02.03.07	Use the concept of betweeness
3.02.03.08	Measure angles correctly
3.02.03.09	Convert between radians and degrees
3.02.04.00	**Describe and apply the properties of similar and/or congruent figures**
3.02.04.01	Be able to make scale drawings
3.02.05.00	**Solve right triangle problems**
3.02.05.01	Apply the Pythagorean Theorem
3.02.05.02	Identify basic functions of sine, cosine and tangent
3.02.05.03	Compute and solve problems using basic trigonometric functions
3.02.06.00	**Demonstrate inductive and deductive reasoning through application to various subject areas**
3.02.06.01	Demonstrate an understanding of and ability to use proof

Numbers and Number Relations

3.03.01.00	**Estimate answers, compute, and solve problems involving real numbers**
3.03.01.01	Round off decimals to one or more places
3.03.01.02	Round and/or truncate numbers to designated place value
3.03.01.03	Round off single and multiple digit whole numbers
3.03.01.04	Estimate measurements

3.03.01.05	Use mental computation when computer and calculator are inappropriate
3.03.01.06	Find the least common denominator of two fractions
3.03.02.00	**Compare and contrast the real number system, the rational number system, and the whole number system**
3.03.03.00	**Determine if a solution to a mathematical problem is reasonable (estimate)**
3.03.04.00	**Select and compute using appropriate units of measure**
3.03.04.01	Convert, compare, and compute with common units of measurement within and/or across measurement systems
3.03.04.02	Use and convert between measurements in the Apothecaries' System of Measurement
3.03.04.03	Use the correct notations from the Apothecaries' System of Measurement

Data Analysis and Probability

3.04.01.00	**Collect and organize data into tables, charts, and graphs**
3.04.01.01	Take a random sample from a population
3.04.03.00	**Understand and apply measures of central tendency, variability, and correlation**
3.04.03.01	Compute and interpret means (averages)
3.04.03.02	Compute and interpret median and/or mode
3.04.03.03	Understand what a normal distribution is
3.04.03.04	Understand what a uniform distribution is

Technical Algebra

3.05.01.00	**Evaluate and graph functions using rectangular coordinates**
3.05.01.01	Graph inequalities in two variables
3.05.02.00	**Solve systems of linear equations and inequalities using matrices, graphs, and algebraic methods**
3.05.02.01	Solve systems of linear equations with up to 3 variables
3.05.02.02	Solve a 2x2 system of linear equations using matrices

3.05.03.00 Understand the complex number system and exhibit facility with its operation

3.05.03.01 Solve problems having complex solutions

3.05.03.02 Examine complex numbers as zeros of a function

3.05.03.08 Add, subtract, multiply and divide complex numbers in rectangular form

3.05.04.00 Analyze exponential functions

3.05.04.02 Do calculations involving exponential expressions and functions

3.05.04.04 Graph exponential functions

3.05.04.06 Use graphing calculators to generate tables to plot exponential curves

3.05.05.00 Simplify and solve quadratic equations

3.05.05.01 Simplify algebraic expressions, multiply and divide polynomials, and solve quadratic equations

3.05.05.02 Solve a quadratic equation by factoring, by completing the square, and by using the quadratic formula

3.05.05.03 Calculate the discriminant of a quadratic equation

3.05.05.04 Put a quadratic equation in standard form and identify a, b, and c

3.05.05.05 Draw conclusions about the solutions of a quadratic equation based upon the value of the discriminant

3.05.05.06 Use a handheld graphic calculator to find the real solutions of a quadratic function to within stated limits of accuracy

3.05.06.00 Analyze rational functions

3.05.06.01 Simplify rational expressions

3.05.06.02 Find the least common denominator of two rational expressions

3.05.06.03 Add, subtract, multiply and divide rational expressions

3.05.06.04 Solve rational equations

3.05.06.05 Identify and describe domain and range of rational functions

3.05.06.06 Define asymptote

3.05.06.07 Identify and describe the asymptotes of a rational function and recognize their significance

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3.05.06.08 Graph rational functions using a handheld graphic calculator

3.05.06.09 Use a handheld graphic calculator to find any intercepts of a rational function to within stated limits of accuracy

Technical Trigonometry

3.06.02.00 Recognize and identify graphs of the trigonometric functions

3.06.02.01 Recognize and graph basic trig curves

**ORGANIC CHEMISTRY **

Chemistry in the Community

Competency 4.03.01 Supplying Our Water Needs

4.03.01.01 List and use the units of the modernized metric system in measurements of length, volume, mass, and density.

4.03.01.02 Discuss direct and indirect water uses and their importance for water conservation.

4.03.01.03 Describe the function and operation of the hydrological cycle and indicate the primary storage reservoirs of the earth's water supply.

4.03.01.04 Discuss some effects of water's unusual physical properties on plants and animals.

4.03.01.05 Define the terms solution, solvent, and solute, and apply them in an example.

4.03.01.06 Classify matter in terms of elements, compounds, and mixtures; and distinguish between different types of mixtures in a lab setting.

4.03.01.07 Interpret the symbols and formulas in a balanced chemical equation in terms of atoms and molecules.

4.03.01.08 Describe the three basic subatomic particles and their connection to the polarity and solubility of a compound.

4.03.01.09 Define the terms insoluble, unsaturated, saturated, and supersaturated, and calculate solution concentration as a percentage.

4.03.01.10 Use solubility curves to describe the effect of temperature on solubility, and calculate percent saturation.

4.03.01.11 Demonstrate the ability to organize and interpret environmental or other data in graphs or tables.

4.03.01.12 Given the pH of a substance, classify it as acidic, basic, or neutral.

4.03.01.13 Determine the formula and name of a simple ionic compound when provided with the anion's and cation's names and charges.

4.03.01.14 Evaluate the risks of contaminants in our water supply, with particular attention to heavy-metal ions of lead, mercury and cadmium.

4.03.01.15 Compare and contrast natural and artificial water purification systems, and assess the risks and benefits of water softening and chlorination.

Competency 4.03.02 Conserving Chemical Resources

4.03.02.01 Compare and contrast science and technology.

4.03.02.02 State the law of conservation of matter, and apply the law by determining whether a given chemical equation is balanced.

4.03.02.03 Describe the Spaceship Earth analogy, and apply it to the terms "throw away" and "using up."

4.03.02.04 List common types and sources of municipal waste, and describe attempts to reuse and recycle waste.

4.03.02.05 Define and give examples of renewable and nonrenewable resources.

4.03.02.06 Distinguish between chemical and physical changes and/or properties when given specific examples of each.

4.03.02.07 Classify selected elements as metals, nonmetals, or metalloids based on observations of their chemical and physical properties.

4.03.02.08 Use the periodic table to predict physical and chemical properties of an element, write formulas for various compounds, identify elements by their atomic masses and atomic numbers, and locate periods and groups of elements.

4.03.02.09 Construct a workable periodic table and explain its organization, given chemical and physical properties of a set of elements.

4.03.02.10 Compare the reactivities of selected elements, and explain the results in terms of the structure of their atoms.

4.03.02.11 Discuss the development of new materials as substitutes for dwindling resources.

4.03.02.12 Explain from a chemical viewpoint the problems and solutions involved in restoring the Statue of Liberty.

4.03.02.13 List the three primary layers of our planet and some resources that are mined from each region.

4.03.02.14 Write balanced chemical equations and relate them to the law of conservation of matter.

4.03.02.15 Define the term mole, and calculate the molar mass of a compound when provided with its formula and the atomic masses of its elements.

4.03.02.16 Outline the production of a metal from its ore and list four factors which determine the profitability of mining.

4.03.02.17 Calculate the percent composition by mass of a specified element in a given compound.

4.03.02.18 Define oxidation and reduction, and compare the three most common redox-reaction methods for separating metals from their ores.

4.03.02.19 Use supply and demand data to estimate the lifetime of a given resource, and discuss options such as reusing, recycling, and substitution.

Competency 4.03.03 Petroleum: To Build or to Burn?

4.03.03.01 Compare the usage of petroleum for building and burning and the benefits and burdens of each usage.

4.03.03.02 Identify regions of high petroleum usage and regions of petroleum reserves, and discuss the economic and political implications of petroleum supply and demand.

4.03.03.03 Describe the chemical makeup of petroleum and its differences from other resources.

4.03.03.04 Identify differences in density and viscosity among common petroleum products, and explain the relationship between the differences and the number of carbon atoms in their molecules.

4.03.03.05 Describe the process of fractional distillation, and list the five major fractions of petroleum distillation and typical products manufactured from each fraction.

4.03.03.06 Name the first ten alkanes and draw structural and electron-dot formulas for each.

4.03.03.07 Describe the processes involved in ionic and covalent bonding.

4.03.03.08 State and explain the effect of carbon length and side groups on the boiling point of a hydrocarbon.

4.03.03.09 Define the term isomer and draw structural formulas for a least three isomers of a given hydrocarbon.

4.03.03.10 Trace the history of energy sources and consumption patterns in the United States, and account for major changes.

4.03.03.11 Explain endothermic and exothermic reactions in terms of bond breaking and bond forming, and give examples of each type of reaction.

4.03.03.12 Identify energy conversions in an automobile, and calculate savings resulting from increased automobile efficiency.

4.03.03.13 Define the terms heat of combustion and specific heat and calculate energies of various combustion reactions.

4.03.03.14 Write balanced equations for the combustion of hydrocarbon fuels, including energy changes.

4.03.03.15 Define the term octane number, state its relationship to grades of gasoline, and identify two ways of increasing octane number.

4.03.03.16 Compare saturated and unsaturated hydrocarbons in terms of molecular models, formulas, structures, and physical and chemical properties.

4.03.03.17 Identify the functional groups for common alcohols, ethers, carboxylic acids, and esters.

4.03.03.18 Describe polymerization and give one example of addition and condensation reactions.

4.03.03.19 Describe major sources of energy for the United States of today, and alternative sources of fuels for the future.

Competency 4.03.04 Understanding Foods

4.03.04.01 Compare the uses of food in terms of building and burning.

4.03.04.02 Distinguish malnutrition from undernutrition, and identify parts of the world where these problems are most acute.

4.03.04.03 Define calorie and joule, and calculate energy changes from calorimetry data.

4.03.04.04 Correlate weight gain or loss with caloric intake and human activity.

4.03.04.05 Compare and contrast mono-, di-, and polysaccharides in terms of structural formulas and properties.

4.03.04.06 Identify key functional groups in carbohydrates and fats, and write an equation for the formation of a typical fat.

4.03.04.07 Distinguish between saturated and unsaturated fats, and relate the consumption of each to health.

4.03.04.08 Define and illustrate the concept of limiting reactant in biochemical examples and in calculations.

4.03.04.09 Describe how functional groups in amino acids interact in protein formation.

4.03.04.10 Describe five functions of proteins in the body.

4.03.04.11 Discuss the concepts of essential amino acids, complete protein, and complementary protein, with respect to a balanced diet.

4.03.04.12 Separate and measure protein and carbohydrates in nonfat mil, and calculate a sample's caloric value.

4.03.04.13 Distinguish water-soluble from fat-soluble vitamins and discuss the implications of these differences in terms of dietary needs.

4.03.04.14 Analyze the vitamin C content of foods by performing titrations.

4.03.04.15 Identify minerals used in the body, and distinguish between macrominerals and trace minerals.

4.03.04.16 Determine the iron content of foods by colorimetry.

4.03.04.17 Discuss the relative risks and benefits of various type of food additives in , terms of their purposes and provide specific examples.

4.03.04.18 Discuss the role of the Food and Drug Administration and federal regulations in ensuring food safety.

4.03.04.19 Compare and contrast menus from several cultures in terms of calories and nutritional balance, and analyze the nutritional quality of food recorded in a personal food diary.

Competency 4.03.05 Nuclear Chemistry in Our World

4.03.05.01 List at least three examples of nuclear technology and or natural radioactivity that affect daily life.

4.03.05.02 Distinguish between ionizing and nonionizing radiation and their biological effects.

4.03.05.03 Discuss general properties of electromagnetic radiation, and specific properties of various regions of the electromagnetic spectrum.

4.03.05.04 Describe the experiments of Roentgen, Becquerel, the Curies, and Rutherford, and explain how they led to modifications in the atomic model.

4.03.05.05 Describe the properties and locations of the three major subatomic particles.

4.03.05.06 Define the term isotope, and interpret isotope notation.

4.03.05.07 Use molar masses and isotopic abundance data to calculate average mass and relative abundance of elements.

4.03.05.08 Compare and contrast the general properties of alpha, beta, and gamma radiation, including penetrating power, and discuss safety considerations in terms of shielding abilities of cardboard, glass, and lead.

4.03.05.09 Balance nuclear equations and use them to describe natural radioactive decay.

4.03.05.10 Explain the concept of half-life and discuss the implications of half-life for natural radioactivity and nuclear waste disposal

4.03.05.11 Describe radiation detectors and their operating principles.

4.03.05.12 Define nuclear transmutation and write a nuclear equation to illustrate the process.

4.03.05.13 Distinguish nuclear fission from nuclear fusion.

4.03.05.14 Use the equation $E = mc2$ to compare the energies produces by nuclear fission and by typical exothermic chemical reactions.

4.03.05.15 Explain the energy effects of a chain reaction and compare a controlled and an uncontrolled reaction.

4.03.05.16 Identify the main components of a nuclear power plant and describe their functions.

4.03.05.17 Assess relative risks and benefits of various nuclear technologies.

4.03.05.18 List and briefly explain some factors that determine the amount of biological radiation damage.

4.03.05.19 Compare the ionizing radiation produced by various sources, including radon, that are encountered by a typical United States citizen.

4.03.05.20 Discuss the problems and possible solutions associated with nuclear waste generation and disposal.

Competency 4.03.06 Chemistry, Air and Climate

4.03.06.01 Describe common physical and chemical properties of air.

4.03.06.02 Compare the chemical properties of nitrogen, oxygen, and carbon dioxide.

4.03.06.03 Identify the major components of the troposphere and indicate their relative concentrations.

4.03.06.04 Show how Avogadro's Law and the concept of molar volume clarify the interpretation of chemical equations involving gases.

4.03.06.05 Describe with words and mathematical equations the interrelationships among amount, temperature, volume, and pressure of a gas, and list one practical application of each law

4.03.06.06 Define and apply in appropriate situations the terms molar volume, standard temperature and pressure, Kelvin temperature scale, and absolute zero.

4.03.06.07 Sketch or graph the relationship between altitude and air pressure.

4.03.06.08 Discuss air pressure and explain how to measure it.

4.03.06.09 Account for the gas laws in terms of the kinetic molecular theory of gases.

4.03.06.10 Compare the various components of solar radiation.

4.03.06.11 Describe how reflection, absorption and re-radiation of solar radiation account for the earth's energy balance.

4.03.06.12 Explain how differing heat capacities and reflectivities of various land covers and water can influence local climates.

4.03.06.13 Describe the greenhouse effect, its natural incidence and causes, and the significance of industrial contributions.

4.03.06.14 Use graphical extrapolation to predict future CO2 concentrations, and outline assumptions and problems associated with such predictions.

4.03.06.15 Compare the production of CO2 from combustion with that from respiration.

4.03.06.16 Describe the function of the ozone layer and how human activities may be affecting it.

4.03.06.17 List the major categories of air pollutants and discuss the relative contributions of various human and natural factors to each category.

4.03.06.18 Describe major general strategies for controlling pollution, and specific strategies for particulates.

4.03.06.19 Describe chemical reactions and geographic and meteorological factors which contribute to photochemical smog.

4.03.06.20 Interpret graphs and tables related to automotive-induce air pollution.

4.03.06.21 Explain the role of activation energy in a chemical reaction, and give and example of how a catalyst affects it.

4.03.06.22 Describe the role of catalytic converters in reducing automotive emissions of unburned hydrocarbons, carbon monoxide, and nitrogen oxides.

4.03.06.23 Describe sources and consequences of acid rain.

4.03.06.24 Define the terms acid and base, give examples, of each, and describe their formation with balanced ionic equations, and relate hydrogen ion concentration to the pH scale.

4.03.06.25 Interpret historical emissions data to assess the success of various pollution control efforts.

4.03.06.26 Discuss air pollution in terms of the trade-offs between control and damage costs.

Competency 4.03.07 Health: Your Risks and Choices

4.03.07.01 Provide examples of correlation, and determine the causal relationship between the members of a given pair of events.

4.03.07.02 Define epidemiology, and describe some benefits and limitations of epidemiological studies.

4.03.07.03 Define homeostasis and give examples of how it is related to maintaining good health.

4.03.07.04 Describe the major elements of the human body and their function in maintaining good health.

4.03.07.05 Explain how enzymes work and list several factors that may alter their effectiveness.

4.03.07.06 Describe cellular energy production and storage, including the role of ATP.

4.03.07.07 Define and give examples of acids and bases, and use net ionic equations to describe the neutralization reaction.

4.03.07.08 Describe the components of a buffer and explain how it prevents acidosis and alkalosis.

4.03.07.09 Apply the concept of like dissolves like to skin cleansing and the function of soap.

4.03.07.010 Sketch the parts of human skin and describe their functions.

4.03.07.11 Describe the effect of sunlight on skin and the effectiveness of PABA in sunscreens.

4.03.07.12 Describe hair structure, the types of bonding in hair protein, and the effects of various hair treatment chemicals on hair.

4.03.07.13 Distinguish between drugs and toxins, and describe circumstances where a substance's usual effect on homeostasis may be reversed.

4.03.07.14 Use the concept of receptors to account for drug specificity and for the action of narcotic analgesics.

4.03.07.15 Contrast the benefits and burdens associated with aspirin use.

4.03.07.16 Outline the effects of common drugs on the human body, and the body's chemical defenses against these drugs.

4.03.07.17 Discuss the role of antigen-antibody complexes in protecting the body against infectious organisms, and contrast the AIDS virus to other viruses.

4.03.07.18 Use the concept of synergism to explain the hazards of combining drugs and medicines.

4.03.07.19 Evaluate the products of cigarette smoking.

4.03.07.20 Assess personal control of risks in terms of the maintenance of good health and well-being.

Competency 4.03.08 The Chemical Industry: Promise and Challenge

4.03.08.01 List the functions of the chemical industry and the general categories of industrial products, including present contributions and future expectations.

4.03.08.02 Contrast responsibilities of the public and of industry in preserving the quality of life in a community.

4.03.08.03 Outline the types of products produced by the chemical industry, and explain the importance of intermediates in production.

4.03.08.04 Evaluate the potentially positive and negative impacts of a chemical industry on a community.

4.03.08.05 Compare natural and synthetic products, providing examples of each.

4.03.08.06 Describe the role of chemical engineers in industry, and the factors that must be considered in changing from laboratory-scale reaction levels to industrial levels.

4.03.08.07 Outline the major divisions and departments of a typical chemical industry, and explain their interrelationships.

4.03.08.08 Analyze a fertilizer sample for its major components, and describe their importance in agriculture.

4.03.08.09 Use colorimetry to quantify phosphate content in fertilizer samples.

4.03.08.10 Apply oxidation-reduction concepts to nitrogen fixation in the Haber process.

4.03.08.11 Use electronegativity values to determine oxidation states.

4.03.08.12 Describe factors that must be controlled in the equilibrium synthesis of ammonia.

4.03.08.13 Trace the history and development of explosives, including the contributions of Alfred Nobel.

4.03.08.14 Develop and evaluate voltaic cells, using the activity series of common metals.

4.03.08.15 Use the concept of half-reactions to describe commercial electrochemical cells, including their charging and discharging reactions.

4.03.08.16 Demonstrate the technique of electroplating.

4.03.08.17 Describe the industrial applications of electrolysis for brine decomposition and for aluminum production.

4.03.08.18 Identify key considerations involved in the development of a new chemical process or product.

Competency 4.03.08 Atomic Theory

4.03.08.01 Describe a mechanism of bond formation and identify the type of chemical bond formed as ionic, covalent, or metallic.

4.03.08.02 Relate the concept of periodicity to atomic properties and the periodic table of elements.

4.03.08.03 Describe charge and ionic compounds in the context of electrochemcial theories.

4.03.08.04 Recognize that the atomic model is only a model and, like any model, is subject to change.

4.03.08.05 Recognize that the atomic model is only a model and, like any model, is subject to change

4.03.08.06 Demonstrate an atomic theory which includes atomic structure, components and their properties, interactions and theory models

4.03.08.07 Demonstrate knowledge of chemical symbolism which will include symbols, formulas, and equations.

Competency 4.03.09 Matter and energy

4.03.09.01 Theme of matter which includes elements, compounds, and mixtures.

4.03.09.02 Relate a chemical equation to the concept of chemical change.

4.03.09.03 Classify matter according to properties and composition.

4.03.09.04 Predict the properties of matter based on data provided in pictures, drawings, charts, graphs, tables, mathematical expressions, and scientific literature.

4.03.09.05 Describe the conservation laws and correctly use the standard units for these laws in relation to conservation of mass/energy and conservation of charge.

4.03.09.06 Describe properties of carbon and organic molecules.

4.03.09.07 State the laws of chemical combinations.

4.03.09.08 List assumptions of the kinetic theory of matter.

4.03.09.09 Understand chemical changes during combustion, and the relationship between these changes and the carbon cycle, and relationship to the greenhouse effect.

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4.03.09.10 Manipulate data in problem solving, including: mole problems, concentration problems, gas law problems atomic/molecular structure problems and equation balancing.

4.03.09.11 Discuss the concept of mole.

4.03.09.12 State the properties of gases and the laws that apply to gases.

4.03.09.13 Identify applications of Avogadro's hypothesis such as Avogadro's number, molar volume, and gram molecular weight/molar mass.

4.03.09.14 Use the kinetic molecular theory to explain states of matter, rates of reaction, and chemical equilibrium.

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GEOLOGY AND HYDROLOGY

Competency 4.04.01 The Study of Geology

4.04.01.01 Compare the Earth to a giant machine.

4.04.01.02 Discuss why understanding geology is useful to everyday living.

4.04.01.03 Outline geologic time and utilize that outline to construct a timeline of the earth's history.

Competency 4.04.02 Atoms, Elements, and Minerals

4.04.02.01 List and describe the most common geologic atoms and element.

4.04.02.02 Describe the chemical composition of the earth's crust.

4.04.02.03 Sketch and label the silica tetrahedron.

4.04.02.04 List and describe the chemical and physical properties of the 12 most common minerals.

4.04.02.05 Explain the rock cycle.

Competency 4.04.03 Volcanism

4.04.03.01 Describe the formation of the Hawaiian geologic complex.

4.04.03.02 List and describe the major volcanic catastrophes affecting humans in recorded history.

4.04.03.03 Identify the major gases involved in volcanism and discuss their biological effects.

4.04.03.04 Discuss the composition and texture of extrusive rocks.

4.04.03.05 Compare and contrast shield volcanoes, cinder cones, composite volcanoes and volcanic dunes.

Competency 4.04.04 Origin of Igneous Rocks

4.04.04.01 Demonstrate the ability to identify and classify intrusive igneous rocks.

4.04.04.02 Explain the abundance and distribution of plutonic rocks.

4.04.04.03 Describe how magma forms.

4.04.04.04 State what Bowen's Reaction Theory is and its relationship to differentiation.

4.04.04.05 Identify the pattern of volcano locations on earth and explain the relationship to plate-techtonics

Competency 4.04.05 Weathering and Soil

4.04.05.01 Discuss the effects of weathering on rocks.

4.04.05.02 Compare and contrast frost action, abrasion, and pressure release.

4.04.05.03 Analyze the role of each of the following chemical weathering agents or reactions: oxygen, acid, solution weathering, feldspar weathering, weathering products.

4.04.05.04 Sketch and label local soil horizons.

4.04.05.05 Identify and discuss local parent rock sources and the effects of local weather on those sources.

4.04.05.06 Determine land capability classification.

4.04.05.07 Determine erosion rates.

4.04.05.08 Interpret aerial photos.

4.04.05.09 Interpret soil survey maps.

4.04.05.10 Identify erosion types.

4.04.05.11 Identify erosion causes.

4.04.05.12 Identify soil erosion control methods.

Competency 4.04.06 Identify soil characteristics

4.04.06.01 Follow general lab safety precautions.

4.04.06.02 Identify the soil horizons of given soil samples.

4.04.06.03 Calculate land slope.

4.04.06.04 Determine soil texture.

4.04.06.05 Determine soil structure.

4.04.06.06 Determine soil type.

4.04.06.07 Determine soil drainage.

4.04.06.08 Determine soil productivity.

Competency 4.04.07 Sediments and Sedimentary Rocks

4.04.07.01 Explain the following paths of sediment: transportation, deposition, preservation, and lithification

4.04.07.02 Identify the most common types of sedimentary rock.

4.04.07.03 Determine the origin and composition of clastic rocks, carbonate rocks, and other sedimentary rocks such as chert, evaporites, and coal

4.04.07.04 Discuss the formation of and weathering of various sedimentary geologic features.

Competency 4.04.08 Metamorphism

4.04.08.01 Describe the composition of metamorphic rocks.

4.04.08.02 Discuss the effect of the following on metamorphic rock : temperature, pressure, stress, foliation, fluid, and time.

4.04.08.03 Identify hydrothermal processes and discuss their potential use as alternative energy sources.

Competency 4.04.09 Determining Geologic Time

4.04.09.01 Interpret stratification as a method of determining relative age.

4.04.09.02 Identify the approximate age of the earth as 4.5 billion years old.

4.04.09.03 Describe the geologically very recent presence of humans on earth.

4.04.09.04 List and describe the major radiometric dating procedures.

Competency 4.04.10 Mass Wasting

4.04.10.01 Calculate the rate of movement of various geologic materials, given a data chart recording time intervals and movement.

4.04.10.02 Relate the type of movement identified to the type of geologic material moving.

4.04.10.03 Explain the effects of gravity and water on mass wasting.

4.04.10.04 Discuss the following common types of mass wasting : creep, debris flow, rockfalls, rockslides.

4.04.10.05 Outline methods to address mass wasting of debris near human development.

4.04.10.06 Describe and sketch methods of preventing rockfalls and rockslides on highways.

Competency 4.04.11 Streams and Landscapes

4.04.11.01 Identify and discuss the stages of the hydrologic cycle.

4.04.11.02 Explain sheet flow.

4.04.11.03 Explain channel flow.

4.04.11.04 Using topographical maps and other information, construct a model or sketch of a drainage basin for a particular geographic area.

4.04.11.05 Discuss the causes and effects of major floods.

4.04.11.06 Explain a flash flood.

4.04.11.07 Evaluate and discuss the effect of each of the following on stream erosion and deposition : velocity, gradient, channel shape, channel roughness, discharge.

4.04.11.08 Using local waterways, identify examples of stream erosion and stream transportation of sediment.

4.04.11.09 List and describe the following examples of stream deposition: bars, braided streams, meandering streams and point bars, flood plains, deltas, and alluvial fans.

4.04.11.10 Classify valley development according to the following methods: downcutting and base level, graded streams, lateral erosion, and headward erosion.

Competency 4.04.12 Ground Water

4.04.12.01 Define Porosity and permeability.

4.04.12.02 Arrange various substrates on a scale of highest to lowest porosity and permeability.

4.04.12.03 Determine the water table level of a study area and monitor it for changes.

4.04.12.04 Explain and then compare and contrast aquifers, wells, springs and rivers.

4.04.12.05 List and describe the major sources of pollution of ground water.

4.04.12.06 Discuss remediation techniques for ground water contamination.

4.04.12.07 Construct a mathematical model that balances withdrawal and recharge in a particular hydrologic area.

4.04.12.08 Utilize computer simulation models and programs (such as STELLA) to describe the hydrologic dynamics of a particular watershed.

4.04.12.09 Assess the effects of ground water action on the following processes and events: caves, sinkholes, and Karst topography.

4.04.12.10 Identify regions of the United States and the world where geothermal energy is a viable alternative to fossil fuels.

Competency 4.04.13 Demonstrate knowledge of the basic concepts of hydrogeology

4.04.13.01 Create cross-sectional diagrams from information provided.

4.04.13.02 Differentiate between a cross-sectional diagram and a fence diagram.

4.04.13.03 Create potentiometric maps from information provided.

4.04.13.04 Determine the direction of groundwater flow from information provided.

4.04.13.05 Create vertical and horizontal isoconcentration maps from information provided.

4.04.13.06 Take groundwater levels from designated monitoring wells or piezomenters.

4.04.13.07 Determine vertical gradients from the given groundwater level of a three-well nest

4.04.13.08 Describe buried valley aquifers and the significance of the "deep stage".

4.04.13.09 Describe Karst topography.

4.04.13.10 Describe sinkholes, their origins, and implications relative to their surface stability

4.04.13.11 Interpret key hydrogeology terminology (eg., sole source aquifer, isotropy, anisotropy, homogeneity, heterogeneity, losing stream, gaining stream, well field, recharge lagoon, groundwater divide, permeability, effective porosity)

4.04.13.12 Identify the components of Darcy's Law.

4.04.13.13 Describe cones of depression in words and pictures.

4.04.13.14 Describe zones of contribution in words and pictures.

4.04.13.15 Describe zones of influence in words and pictures.

Competency 4.04.14 Assist in determining the quality and quantity of water resources

4.04.14.01 Identify the hydrologic cycle and major uses for water.

4.04.14.02 Assist in identifying present and potential sources of water pollution in a local area

4.04.14.03 Assist in determining the quality of given samples of water.

4.04.14.04 Calculate the volume and surface area of ponds, lakes, and streams.

4.04.14.05 Assist in planning improvements for waterways, ponds, stream banks, and shorelines

Competency 4.04.15 Glaciers and Glaciation

4.04.15.01 Construct a time-line of the major glaciers that have shaped the students region of the country.

4.04.15.02 Analyze and discuss a map showing the distribution of glaciers.

4.04.15.03 Identify the major types of glaciers.

4.04.15.04 Classify the most common types of glacial erosion and glacial deposition.

Competency 4.04.16. Demonstrate knowledge of the basic concepts of glacial geology

4.04.16.01 Develop a chronology of the events associated with glacial advancements.

4.04.16.02 Describe glacial till.

4.04.16.03 Describe outwash deposits and their relevance to groundwater.

4.04.16.04 Describe valley train deposits and their impact on groundwater flow.

4.04.16.05 Describe glacial kame, their origins, and resulting land forms.

4.04.16.06 Describe the characteristics and origins of glacial moraines.

4.04.16.07 Describe the characteristics and origins of glacial drumlins.

4.04.16.08 Describe how glacial advancements reshaped the landscape resulting in present-day drainage patterns (watersheds)

Competency 4.04.17 Geologic Structures

4.04.17.01 Define the tectonic forces known as stress and strain.

4.04.17.02 Identify horizontal and inclined layers of rocks in a geologic diagram as discuss the structures as a record of the geologic past.

4.04.17.03 Construct a geologic map of a study area, utilizing data gathered with field techniques.

4.04.17.04 Discuss the geometry and interpretation of geologic folds.

4.04.17.05 On a map of the world, identify the major joint and fault lines.

Competency 4.04.18 Earthquakes

4.04.17.01 List and describe the major causes of earthquakes.

4.04.17.02 Define a seismic wave.

4.04.17.03 Relate the effects of earthquakes and tsunamis.

4.04.17.04 Using a world map, illustrate the world distribution of earthquakes and discuss the causes of the distribution pattern.

4.04.17.05 Assess the current techniques for earthquake prediction and control.

Competency 4.04.18 The Earth's Interior

4.04.18.01 Sketch and explain the earth's internal composition and structure.

4.04.18.02 Define isostasy.

4.04.18.03 Discuss the earth's magnetic field and gravity measurements.

4.04.18.04 Explain how heat from within the earth is distributed and mechanisms for that heat to reach the surface.

Competency 4.04.19 Plate Tectonics

4.04.19.01 Discuss paleomagnetism and recent evidence for continental drift. features of good equipment design

4.04.19.02 Outline the history of continental positions

4.04.19.03 Explain Hess's driving force and the relationship to sea floor spreading.

4.04.19.04 List and describe the following evidence of plate movement: marine magnetic anomalies, fracture zones and transform faults and measurements of direct plate motion.

4.04.19.05 Identify the causes of plate movement.

Competency 4.04.20 Geologic Resources

4.04.20.01 List and describe the major types of geologic resources.

4.04.20.02 List and then rank in order the major geologic resources used today.

4.04.20.03 Outline the origin of oil and gas.

4.04.20.04 Identify the areas where there are major occurrences of oil and gas reserves.

4.04.20.05 Explain the most common methods of oil recovery.

4.04.20.06 State the various predictions being made on the amount of oil resources we have left.

4.04.20.07 Distinguish the resources known as heavy crude and oil sands.

4.04.20.08 Discuss the importance and use of oil shade.

4.04.20.09 Identify on a map the location of the major deposits and types of coal reserves.

4.04.20.10 List and describe the environmental effects of mining and burning coal.

4.04.20.11 Trace the history of the use of uranium and the effects of mining and using uranium as a resource.

4.04.20.12 Identify and describe six major alternative sources of energy.

4.04.20.13 List the major metals and ores being mined today.

4.04.20.14 Compare and contrast ores associated with igneous rocks and ores formed by surface processes.

4.04.20.15 Explain the relationship between metal ores and plate tectonics.

4.04.20.16 List and describe the major ore mining techniques and their effects on the environment.

4.04.20.17 List and describe the importance of the following metals: iron, copper, aluminum, lead, zinc, silver, gold.

4.04.20.18 Identify the uses of geologic resources for construction materials and fertilizers and evaporites.

4.04.20.19 Describe the recycling processes being used today for geologic resources and the advantages and disadvantages of recycling compared to newly mined materials.

4.04.20.20 Identify major conservation techniques being used in the private and public sectors to conserve geologic resources.

4.04.20.21 Predict the future trends in the use and development of geologic resources.

COMPUTER LITERACY

10.04.01.00 Demonstrate knowledge of Computer Literacy I for Windows

10.04.01.01 Explain what a computer is and how it processes data to produce information

10.04.01.02 Identify the four operations of the information processing cycle: input, process, output, and storage

10.04.01.03 Explain how the operations of the information processing cycle are performed by computer hardware and software

10.04.01.04 Describe the elements of an information system: equipment, software, data, personnel, users, and procedures

10.04.01.05 Explain the responsibilities of information system personnel

10.04.01.06 Explain the use of computers in our world

10.04.01.07 Identify the most widely used general microcomputer software applications and their key processing features

10.04.01.08 Describe how each application can help users

10.04.01.09 Explain integrated software and its advantages

10.04.01.10 List and describe the guidelines for purchasing hardware and software packages

10.04.01.11 List and describe the learning aids and support tools that help users to use microcomputer applications

10.04.01.12 Define the types of inputs and outputs and how the computer uses each type

10.04.01.13 Define data and explain the terms used to describe data: field, record, file, database

10.04.01.14 Describe the standard features of keyboards, and explain how to use the cursor control and function keys

10.04.01.15 Explain the types of terminals and how they are used

10.04.01.16 Explain user interfaces and list the features that a good user interface should have

10.04.01.17 Discuss how data entry differs in interactive and batch processing

10.04.01.18 List and explain the systems and procedures associated with data entry

10.04.01.19 Explain the term ergonomics and describe some of the important features of good equipment design

10.04.01.20 Identify the components of the processor unit and describe their use

10.04.01.21 Define a bit and describe how a series of bits in a byte is used to represent characters

10.04.01.22 Discuss how the ASCII and EBCIDIC codes represent characters

10.04.01.23 Discuss the primary factors that affect the speed of the processor unit

10.04.01.24 Describe the characteristics of RAM and ROM memory, and list several other types of memory

10.04.01.25 List the common types of reports that are used for output

10.04.01.26 Describe multimedia

10.04.01.27 Describe the features and classifications of printers

10.04.01.28 Identify and explain the differences of impact and non-impact printers

10.04.01.29 Describe the types of screens available and list common screen features

10.04.01.30 Define auxiliary storage

10.04.01.31 Describe the forms of auxiliary storage used and how special-purpose storage devices are used

10.04.01.32 Explain how data is stored on diskettes, hard disks and tape

10.04.01.33 Explain how data stored on magnetic disks can be protected

10.04.01.34 Explain what data management is and why it is needed

10.04.01.35 Describe sequential files, indexed files, and direct (or relative) files

10.04.01.36 Explain the difference between sequential and random retrieval of record from a file

10.04.01.37 Describe the data maintenance procedures for updating data including adding, changing, and deleting

10.04.01.38 Discuss the advantages of a database management system (DBMS)

10.04.01.39 Define and describe the basic components of a communications system

10.04.01.40 Describe the various transmission media and line configurations used for communication channels

10.04.01.41 Identify and explain the communications equipment used in a communications system

10.04.01.42 Describe the functions performed by communications software including how data is transmitted

10.04.01.43 List the major categories of networks and describe the common network configurations

10.04.01.44 Describe how bridges and gateways are used to connect networks

10.04.01.45 Define the term management information systems and explain how information is important to an organization

10.04.01.46 Discuss the different levels in an organization and how the information requirements differ for each level

10.04.01.47 Define the term information system and identify the elements of an information system

10.04.01.48 Describe the different types of information systems and the trend toward integration

10.04.01.49 Explain how personal computers are used in management information systems

10.04.01.50 Discuss how electronic devices and applications are used in the automated office

10.04.01.51 Describe the technologies that are developing for the automated factory

10.04.01.52 Discuss the trend toward computer-integrated enterprise

10.04.01.53 Discuss the use of personal computers in the home

10.04.01.54 Describe the methods used in computer-aided instruction (CAI)

10.04.01.55 Explain the guidelines for purchasing personal computers

10.04.01.56 Discuss the social issues relating to computers

10.04.01.57 Define data and information

10.04.01.58 Describe the use and handling of diskettes and hard disks

10.04.01.59 Discuss computer software and explain the difference between application software and system software

10.04.01.60 Describe what a graphic user interface (GUI) is

10.04.01.61 Identify the elements of a window

10.04.01.62 Perform basic mouse operations

10.04.01.63 Perform the following window operations; choose a command from a menu; respond to dialogue boxes; name a file; explain what a directory, subdirectory and path are; open, enlarge and scroll a window; and obtain on-line help while using an application

EMPLOYABILITY SKILLS

11.02.01.00	**Investigate career options**
11.02.01.01	Determine interests and aptitudes
11.02.01.02	Identify career options
11.02.01.03	Research occupations matching interests and aptitudes
11.02.01.04	Select career(s) that best match(es) interests and aptitudes
11.02.01.05	Identify advantages and disadvantages of career options, including nontraditional careers, hours of work, offshift, weekends, and holidays
11.02.01.06	Assess differences in wages, annual incomes, and job opportunities based on geographical location
11.02.01.07	Develop a career plan
11.02.02.00	Analyze potential barriers to employment
11.02.02.01	Identify common barriers to employment
11.02.02.02	Describe strategies to overcome employment barriers
11.02.03.00	**Apply decision-making techniques in the workplace**
11.02.03.01	Identify the decision to be made
11.02.03.02	Compare alternatives
11.02.03.03	Determine consequences of each alternative
11.02.03.04	Make decisions based on values and goals
11.02.03.05	Evaluate the decision made
11.02.04.00	**Apply problem-solving techniques in the workplace**
11.02.04.01	Diagnose the problem and its causes
11.02.04.02	Identify alternatives and their consequences in relation to the problem
11.02.04.03	Examine multicultural and nonsexist dimensions of problem solving
11.02.04.04	Utilize resources to explore possible solutions to the problem
11.02.04.05	Compare and contrast the advantages and disadvantages

11.02.04.06	Determine appropriate action
11.02.04.07	Evaluate results
11.02.05.00	**Evaluate the relationship of self-esteem to work ethic**
11.02.05.01	Identify special characteristics and abilities in self and others
11.02.05.02	Identify internal and external factors that affect self-esteem
11.02.06.00	Analyze the relationship of personal values and goals to work ethic in and out of the workplace
11.02.06.01	Distinguish between values and goals
11.02.06.02	Determine the importance of values and goals
11.02.06.03	Evaluate how values affect goals
11.02.06.04	Identify short-term and long-term goals
11.02.06.05	Prioritize personal goals
11.02.06.06	Describe how personal values are reflected in work ethic
11.02.06.07	Describe how interactions in the workplace affect personal work ethic
11.02.07.00	**Demonstrate work ethic**
11.02.07.01	Examine factors that influence work ethic
11.02.07.02	Exhibit characteristics that reflect an appropriate work ethic
11.02.08.00	**Prepare for employment**
11.02.08.01	Identify traditional and nontraditional employment sources
11.02.08.02	Utilize employment sources
11.02.08.03	Research job opportunities, including nontraditional careers
11.02.08.04	Interpret equal employment opportunity laws
11.02.08.05	Explain the critical importance of personal appearance, hygiene, and demeanor throughout the employment process
11.02.08.06	Prepare for generic employment tests and those specific to an occupation/organization
11.02.09.00	Design a resume

11.02.09.01 Identify personal strengths and weaknesses

11.02.09.02 List skills and/or abilities, career objective(s), accomplishments/achievements, educational background, and work experience

11.02.09.03 Demonstrate legible written communication skills using correct grammar, spelling, and concise wording

11.02.09.04 Complete resume using various formats

11.02.09.05 Secure references

11.02.10.00 Complete and process job application forms

11.02.10.01 Explain the importance of an application form

11.02.10.02 Identify ways to obtain job application forms

11.02.10.03 Describe methods for handling illegal questions on job application forms according to EOE regulations

11.02.10.04 Demonstrate legible written communication skills using correct grammar, spelling, and concise wording

11.02.10.05 Return application to proper person, request interview, and follow up

11.02.11.00 Demonstrate interviewing skills

11.02.11.01 Investigate interview environment and procedures

11.02.11.02 Explain the critical importance of personal appearance, hygiene, and demeanor

11.02.11.03 Demonstrate question and answer techniques

11.02.11.04 Demonstrate methods for handling difficult and/or illegal interview questions following EOE guidelines

11.02.12.00 Secure employment

11.02.12.01 Identify present and future employment opportunities within an occupation/organization

11.02.12.02 Research the organization/company

11.02.12.03 Use follow-up techniques to enhance employment potential

11.02.12.04 Compare and evaluate job offers

11.02.13.00 Analyze the organizational structure of the workplace

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11.02.13.01 Identify and evaluate employer expectations regarding job performance, work habits, attitudes, personal appearance, and hygiene

11.02.13.02 Be aware of and obey all company policies and procedures

11.02.13.03 Examine the role/relationship between employee and employer

11.02.13.04 Recognize opportunities for advancement and reasons for termination

11.02.14.00 Maintain positive relations with others

11.02.14.01 Exhibit appropriate work habits and attitude

11.02.14.02 Identify behaviors to establish successful working relationships

11.02.14.03 Cooperate and compromise through teamwork and group participation

11.02.14.04 Identify alternatives for dealing with harassment, bias, and discrimination based on race, color, national origin, sex, religion, handicap, or age

11.02.15.00 Analyze opportunities for personal and career growth

11.02.15.01 Determine opportunities within an occupation/organization

11.02.15.02 Compare and contrast other opportunities

11.02.15.03 List benefits of job advancement

11.02.15.04 Evaluate factors involved when assuming a new position within or outside an occupation/organization

11.02.16.00 Exhibit characteristics needed for advancement

11.02.16.01 Display a positive attitude

11.02.16.02 Demonstrate knowledge of a position

11.02.16.03 Perform quality work

11.02.16.04 Adapt to changing situations and technology

11.02.16.05 Demonstrate capability for different positions

11.02.16.06 Participate in continuing education/training programs

11.02.16.07 Respect, accept, and work with ALL individuals in the workplace

11.02.17.00 Assess the impact of technology in the workplace

11.02.17.01 Cite how past business/industry practices have influenced present business/industry

	processes
11.02.17.02	Investigate the use of technology in the workplace
11.02.17.03	Analyze how present skills can be applied to learning new technologies
11.02.18.00	**Use a variety of technological applications**
11.02.18.01	Explore basic mathematical, scientific, computer, and technological principles
11.02.18.02	Use technology to accomplish assigned tasks
11.02.18.03	Create solutions to problems using technical means
11.02.19.00	**Apply lifelong learning to individual situations**
11.02.19.01	Define lifelong learning
11.02.19.02	Identify factors that cause the need for lifelong learning
11.02.20.00	**Adapt to change**
11.02.20.01	Analyze the effect of change
11.02.20.02	Identify reasons why goals change
11.02.20.03	Describe the importance of flexibility when reevaluating goals
11.02.20.04	Evaluate the need for continuing education/training
11.02.21.00	**Analyze global enterprise system**
11.02.21.01	Identify characteristics of various enterprise system
11.02.21.02	Examine the relationship between competition, risk, and profit
11.02.21.03	Illustrate how supply and demand influence price
11.02.22.00	**Evaluate personal money management**
11.02.22.01	Describe the need for personal management records
11.02.22.02	Identify methods of taxation
11.02.22.03	Analyze how credit affects financial security
11.02.22.04	Compare types and methods of investments
11.02.22.05	Prepare a personal budget

11.02.22.06	**Be an informed and responsible consumer**
11.02.22.07	Analyze the effects of advertising on the consumer
11.02.23.00	**Analyze the effects of family on work**
11.02.23.01	Recognize how family values, goals, and priorities are reflected in the workplace
11.02.23.02	Identify present and future family structures and responsibilities
11.02.23.03	Describe personal and family roles
11.02.23.04	Analyze concerns of parents who work outside the home
11.02.23.05	Examine how family responsibilities can conflict with work
11.02.23.06	Resolve family-related conflicts
11.02.23.07	Explain how to use support systems/community resources to help resolve family-related conflict
11.02.24.00	**Analyze the effects of work on family**
11.02.24.01	Identify responsibilities associated with paid and nonpaid work
11.02.24.02	Compare the advantages and disadvantages of multiple incomes
11.02.24.03	Explain how work can conflict with family responsibilities
11.02.24.04	Explain how work-related stress can affect families
11.02.24.05	Identify family support systems and resources
11.02.24.06	Identify stress management options to alleviate occupational "burnout"
11.02.25.00	**Exercise the rights and responsibilities of citizenship in the workplace**
11.02.25.01	Identify the basic rights and responsibilities of citizenship
11.02.25.02	Examine the history and contributions of all racial, ethnic, and cultural groups
11.02.26.00	Cooperate with others in the workplace
11.02.26.01	Identify situations in which compromise is necessary
11.02.26.02	Examine how individuals from various backgrounds contribute to work-related situations
11.02.26.03	Demonstrate initiative to facilitate cooperation

11.02.26.04	Give and receive constructive criticism to enhance cooperation
11.02.27.00	**Evaluate leadership styles appropriate for the workplace**
11.02.27.01	Identify characteristics of effective leaders
11.02.27.02	Compare leadership styles including non-traditional "coaching"
11.02.27.03	Demonstrate effective delegative skills
11.02.27.04	Identify opportunities to lead in the workplace
11.02.28.00	**Demonstrate effective teamwork skills**
11.02.28.01	Identify the responsibilities of a valuable group member
11.02.28.02	Exhibit open-mindedness
11.02.28.03	Identify methods of involving each member of a team
11.02.28.04	Contribute to the efficiency and success of a group
11.02.28.05	Determine ways to motivate others
11.02.28.06	Explain the advantage of team decisions
11.02.28.07	Prepare and plan an agenda
11.02.28.08	Develop a plan of action
11.02.28.09	Assess success or failure of team
11.02.29.00	Utilize effective communication skills
11.02.29.01	Identify the importance of active listening
11.02.29.02	Demonstrate assertive communication
11.02.29.03	Recognize the importance of verbal and nonverbal cues and messages
11.02.29.04	Analyze written material
11.02.29.05	Prepare written material
11.02.29.06	Give and receive feedback
11.02.29.07	Articulate thoughts
11.02.29.08	Use appropriate language
11.02.29.09	Demonstrate the value of networking

11.02.30.00 Evaluate the role of small business in the economy

11.02.30.01 Identify the benefits of small business to a community

11.02.30.02 Analyze opportunities for small business in a community

11.02.31.00 Examine considerations of starting a business

11.02.31.01 Research a business idea

11.02.31.02 Compare various ways to become a small business owner

11.02.31.03 Investigate factors to consider in financing a new business

11.02.31.04 Evaluate entrepreneurship as a career option

SECONDARY/TECHNICAL COMPETENCIES

****ENVIRONMENTAL MANAGEMENT/RESOURCE CONSERVATION****

Water Quality And Quantity

Competency 13.01.01 Monitor water quality and quantity (EMOCAP)

13.01.01.01 Comply with established laws and regulations concerning the treatment of water.

13.01.01.02 Collect water samples

13.01.01.03 Analyze samples for water quality

13.01.01.04 Implement pollution abatement measures

13.01.01.05 Identify types of well construction and development

13.01.01.06 Control fugitive dusts

13.01.01.07 Identify Class I, Class II , and Class III macroinvertebrates

13.01.01.08 Explain the importance of macroinvertebrates as indicators of water quality

Competency 13.01.02 Identify and assess stream dynamics (R)

13.01.02.01 Follow general safety precautions

13.01.02.02 Identify a watershed area

13.01.02.03 Identify disturbances and destructive forces

13.01.02.04 Determine stream profile

13.01.02.05 Evaluate stream corridor improvement

13.01.02.06 Identify nonpoint source pollution

13.01.02.07 Measure stream velocity

13.01.02.08 Measure stream volume

Competency 13.01.03 Determine water quality parameters (R)

13.01.03.01 Follow general safety precautions

13.01.03.02 Measure turbidity

13.01.03.03 Measure p.H.

13.01.03.04 Measure temperature

13.01.03.05 Measure dissolved oxygen

13.01.03.06 Profile dissolved oxygen and temperature

13.01.03.07 Survey macroinvertebrates

13.01.03.08 Identify pollution sources

13.01.03.09 Identify water quality indicators

13.01.03.10 Measure alkalinity

13.01.03.11 Measure residue content

13.01.03.12 Measure fecal coliform count

13.01.03.13 Measure phosphorus level

13.01.03.14 Measure nitrate level

13.01.03.15 Measure sulfate level

13.01.03.16 Measure chloride level

13.01.03.18 Interpret water test results

Competency 13.01.04 Describe scientific fundamentals necessary for proficient water and wastewater treatment.(EMAC)

13.01.04.01 Explain basic concepts of general, quantitative, physical and organic chemistry

13.01.04.02 Discuss adaptation to water and wastewater chemistry

13.01.04.03 Explain analytical techniques, sampling, "pitfalls", etc.

13.01.04.04 Explain interfering substance, recognition, effects, etc.

13.01.04.05 Explain chemical analyses of water and wastewater and their interpretation

13.01.04.06 Identify toxic substances

Competency 13.01.05 Describe Slow Measurement Pumps, Temperature Influences (EMAC)

13.01.05.01 Explain hydraulics, flow measurement, pumping, pressures, velocities

13.01.05.02 Discuss electricity, measurement, use of electrical energy, equations, etc.

13.01.05.03 Discuss temperature and its effects, heat exchange, etc.

13.01.05.04 Discuss mechanical energy, motors, transmission

13.01.05.05 Discuss energy conversion equations

13.01.05.06 Discuss weather effects, water cycle

13.01.05.07 Discuss hydraulic, electrical and mechanical tests and their interpretation

Competency 13.01.06 Demonstrate Understanding of water resources protection, quantity and quality of water (EMAC)

13.01.06.01 Explain the importance of water quality, upstream and downstream quality

13.01.06.02 Explain dissolved oxygen

13.01.06.03 Explain self-purification, dilution

13.01.06.04 Explain effects of flow, floods, droughts

13.01.06.05 Define water pollution

13.01.06.06 Discuss anticipating water pollution problems, effects on water supplies

Competency 13.01.07 Describe the theoretical and practical application of processes utilized in water and wastewater treatment (EMAC)

13.01.07.01 Explain the theory, description and knowledge of the water treatment process

13.01.07.02 Explain wastewater theory, description and knowledge of the treatment processes

13.01.07.03 Create flow diagrams of water and wastewater processes

13.01.07.04 Discuss design criteria: Hydraulic and organic loading, population equivalents, industrial wastes.

13.01.07.05 Explain application of processes

13.01.07.06 Explain limitations of processes

13.01.07.07 Discuss process performance, expected efficiencies, actors affecting performance

13.01.07.08 Discuss processing problems

13.01.07.09 Discuss innovative and alternative processes

13.01.07.10 Discuss evaluation of performance, sampling, analyses, interpretation of analyses, calculating effectiveness

Competency 13.01.08 Describe the "total" treatment process (EMAC)

13.01.08.01 Explain the concept of physical, chemical, and biological as related to the treatment process

13.01.08.02 Discuss applications of total treatment

13.01.08.03 Explain limitations of total treatment

13.01.08.04 Explain design criteria

Competency 13.01.09 Describe effective, responsible operation and maintenance of water and wastewater treatment plants (EMAC)

13.01.09.01 Discuss raw wastewater coming into the plant

13.01.09.02 Discuss loading at water treatment plants

13.01.09.03 Discuss treatment objectives at water treatment plants

13.01.09.04 Discuss process control at water treatment plants

13.01.09.05 Discuss operating difficulties and problems at water treatment plants

13.01.09.06 Discuss maintenance at a treatment plant

13.01.09.07 Practice safety procedures

13.01.09.08 Respond to simulated emergencies

13.01.09.09 Demonstrate proper laboratory practices

Competency 13.01.10 Describe Distribution Systems - Water (Class I and Class II) (EMAC)

13.01.10.01 Discuss description, function, operation and control

13.01.10.02 Explain disinfection of water mains, reservoirs, tanks, etc.

13.01.10.03 Explain maintenance of disinfection residual, public health hazards

13.01.10.04 Discuss breaks in mains, hydrants, reservoirs, procedure for handling and disinfection

13.01.10.05 Discuss storage: ground reservoirs, elevated tanks

13.01.10.06 Discuss pumping: high-service, multiple high service, pumping problems

13.01.10.07 Discuss distribution system maintenance, flushing, cleaning mains, etc.

13.01.10.08 Explain corrosion; its causes and prevention

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13.01.10.09 Discuss water shortages

Competency 13.01.11 Describe Collection Systems - Wastewater (Class I and Class II) (EMAC)

13.01.11.01 Discuss description, function, operation and control

13.01.11.02 Discuss pollution prevention, by-passing, cleaning, regulators, illegal connections, storm-water connections

13.01.11.03 Discuss pumping, corrosion, electrical and mechanical problems, safety

13.01.11.04 Discuss maintenance, cleaning sewers, safety

13.01.11.05 Discuss infiltration/inflow, rates of inflow, correction

13.01.11.06 Discuss abuse of sewers : improper connections, poor laterals, downspouts, storm water connections

Competency 13.01.12 Describe proper discharge of duties for a certified operator in responsible charge of a water or wastewater plant or facility (EMAC)

13.01.12.01 List reasons for water treatment

13.01.12.02 List reasons for wastewater treatment

13.01.12.03 Explain significance of job as water or wastewater plant operator

13.01.12.04 List troubleshooting problems in plant

13.01.12.05 List personal qualities of a supervisor

13.01.12.06 Identify construction cost of wastewater plants

13.01.12.07 Compute unit cost of treatment for operation and maintenance, reserves and principal and interest on bonds

13.01.12.08 Compute unit cost of treatment including operation, maintenance, reserves and principal and interest on bonds

13.01.12.09 Compare consumer cost-comparison to other utilities

13.01.12.10 Use different approaches to problem solving

13.01.12.11 Write a plan for supervision of employees

LOCAL AND GLOBAL NATURAL RESOURCES

Competency 13.02.01 Conduct lab and field analyses (EMOCAP)

13.02.01.01 Perform Biochemical Oxygen Demand (BOD) analyses

13.02.01.02 Perform Chemical Oxygen Demand (COD) analyses

13.02.01.03 Perform specific conductivity analyses

13.02.01.04 Perform suspended solids analyses

13.02.01.05 Measure water hardness

13.02.01.06 Measure water level and flow

Competency 13.02.02 Identify global food resources and hunger (EMAC)

13.02.02.01 Differentiate between malnutrition and undernutrition

13.02.02.02 Identify food resource problems within rain forests and semiarid lands

13.02.02.03 Identify the variables that control agricultural production

13.02.02.04 Identify reasons for maintaining soil quality

13.02.02.05 Identify the characteristics of crop irrigation management

13.02.02.06 Identify ways in which biotechnology may influence the future of agricultural science

13.02.02.07 Identify the problems associated with harvesting oceans

13.02.02.08 Identify aquaculture successes and limitations

RESOURCE MANAGEMENT

Competency 13.03.01 Describe management of Forests, Rangelands, Parks, and Wetlands (EMOCAP)

13.03.01.01 Discuss the history of land management

13.03.01.02 Identify congressional mandated areas

13.03.01.03 Outline examples of conflicts facing federal public lands

13.03.01.04 Discuss fire management techniques

13.03.01.05 Provide justification for preserving wilderness areas

13.03.01.05 Explain the economic and environmental value of inland wetlands

13.03.01.05 Discuss drilling controversies

Competency 13.04.01 Demonstrate knowledge of recycling of waste (EMAC)

13.04.01.01 Identify landfills and available space for present and future solid waste disposal

13.04.01.02 Identify resources available through recycled solid waste management

13.04.01.03 Prepare an "Improvement Project" in the areas of controlling solid waste

Competency 13.05.01 Identify pest-management methods (EMOCAP)

13.05.01.01 Identify the characteristic of various pest species

13.05.01.02 Identify the goals of pest-eradication programs in the United States

13.05.01.03 Identify the impact of this nation's pest-eradication programs on the environment

13.05.01.04 Describe the various types of pesticides

13.05.01.05 Describe the pros and cons of synthetic pesticide use

13.05.01.06 Identify alternative pest-control measures

13.05.01.07 Describe the environmental impact of different types of pest-control measures

13.05.01.08 Identify the steps in the evolution of natural pesticides

13.05.01.09 Identify the strengths and weaknesses of using sex attractants, growth regulators, and sterilization to control insect pests

13.05.01.10 Identify disease-resistant cultivators

13.05.01.11 Identify pest-management techniques

13.05.01.12 Identify the components of an integrated pest-management program

13.05.01.13 Describe the pesticide applicators' license

13.05.01.15 Recognize pest damage

13.05.01.16 Identify disease organism structures

13.05.01.17 Estimate pest population numbers

Competency 13.06.01 Assist in managing wildlife population growth and reproduction (EMOCAP)

13.06.01.01 Identify the private, state, and federal agencies that are involved in animal wildlife conservation

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13.06.01.02 Identify the species of land and aquatic wildlife common to a local area

13.06.01.03 Classify common species of land and aquatic wildlife as game, nongame, endangered, or threatened

13.06.01.04 Identify the characteristics of wildlife population dynamics

13.06.01.05 Identify established management practices for wildlife habitats

13.06.01.06 Comply with wildlife, game and fishing laws, rules, and regulations

13.06.01.07 Identify pest, insects, and diseases associated with common wildlife

13.06.01.08 Identify the characteristics of wildlife populations

Competency 13.07.01 Identify wildlife management techniques (R)

13.07.01.01 Identify basic reasons for wildlife management

13.07.01.02 Identify basic wildlife management practices for various game and nongame species

13.07.01.03 Identify common game and nongame species

13.07.01.04 Collect and prepare study skins of various game and non-game species

13.07.01.05 Identify different types of capture techniques

13.07.01.06 Identify basic types of equipment used in wildlife management

13.07.01.07 Identify importance of habitat development as it relates to wildlife populations

13.07.01.08 Identify advantages and disadvantages of introduction of wildlife species to new habitats

13.07.01.09 Identify different types of population control

13.07.01.10 Identify types of population density surveys

13.07.01.11 Identify importance of habitat evaluation and cover mapping

13.07.01.12 Identify carrying capacities for various species

13.07.01.13 Prepare a wildlife management plan

ENVIRONMENTAL INDUSTRIAL TECHNOLOGY

Competency 13.08.01 Prevention of Environmental Problems (EMAC)

13.08.01.01 Develop contingency plan

13.08.01.02 Review contingency plan

13.08.01.03 Identify and report potential hazards

13.08.01.04 Demonstrate how to monitor discharges and wastes

Competency 13.08.02 Demonstrate understanding of industry (EMAC)

13.08.02.01 Identify areas of environmental industrial technology

13.08.02.02 Identify the economic importance of the industry

13.08.02.03 Identify the environmental importance of the industry

13.08.02.04 Identify current employment opportunities

13.08.02.05 List and identify the regulatory aspects of industry

13.08.02.06 Describe the continuing-educational opportunities

13.08.02.07 List professional organizations and trade journals

13.08.02.08 Describe how to locate state licensing requirements

Competency 13.08.03 Identify Industrial Safety and Health Requirements (EMAC)

13.08.03.01 Understand the definition of a confined space **(I.A.W.O.S.H.A 29 C.F.R.1910.146)**

13.08.03.02 Demonstrate knowledge of occupational noise exposure **(I.A.W. O.S.H.A. 29 C.F.R. 1910.95)**

13.08.03.03 Recognize examples of heat stress in industry

13.08.03.04 Recognize example of cold stress in industry

13.08.03.05 Demonstrate key aspects of personnel decontamination

13.08.03.06 Identify types of personnel protective equipment used in the environmental field

GENERAL WORK SAFETY

Competency 13.09.01 Maintain safe work environment (EMOCAP)

13.09.01.01 Comply with lab and equipment rules

13.09.01.02 Maintain clean and safe work area

13.09.01.03 Know location of safety devices (fire ext., etc)

13.09.01.04 Locate material safety data sheets

13.09.01.05 Define the purpose of MSDS

13.09.01.06 Follow safety information contained in MSDS or HMIS (Health Material Information System)

13.09.01.07 Identify the location of hazardous materials

13.09.01.08 Store hazardous materials according to manufacturer's specifications

13.09.01.09 Describe the reporting and corrective actions to be taken in a given hazardous situation

13.09.01.10 Describe the procedures for cleaning up leaks and spills

13.09.01.11 Clean up leaks and spills

13.09.01.12 Comply with responder first-aid and cardiopulmonary resuscitation certification standards. Recognize early warning signs of heart attacks and stroke. List and describe the proper techniques for artificial respiration, bleeding control, treatment of shock, and care of fractures.

13.09.01.13 Describe injury and accident reporting system

13.09.01.14 Complete accident reports

Competency 13.09.02 Demonstrate knowledge of environmental chemistry (EMAC)

13.09.02.01 Describe the requirements of a chemical hygiene plan **(I.A.W. O.S.HA. 1910-145)**

13.09.02.02 Identify the job functions of a Chemical Technician

13.09.02.03 Demonstrate knowledge of the chemistry of fire **(I.A.W. O.S.H.A. 29 C.F.R 1926.352 (e) and O.S.H.A. 29 C.F.R 1910.157 (g)**

Competency 13.09.03 Demonstrate knowledge of environmental toxicology (EMAS)

13.09.03.01 Describe Routes of entry

13.09.03.02 Explain the biological process of bioaccumulation and its effects on various populations in the environment

13.09.03.03 Distinguish between acute and chronic biological effects

13.09.03.04 Explain LD_{50}

13.09.03.05 Distinguish between carcinogens, mutagens, and teratogens

13.09.03.06 Outline the body's natural defenses

13.09.03.07 Describe the process of assessing environmental toxins

13.09.03.08 Distinguish between individual and societal risks

INDUSTRIAL POLLUTION CONTROL

Competency 13.10.01 Demonstrate knowledge of industrial pollution control (CSU)

13.10.01.01 List and describe disposal and management process utilized in industrial pollution control. Develop familiarity with remediation equipment technologies and other control technologies, such as pollution prevention, air pollution control devices, water treatment, and solid and hazardous waste treatment.

13.10.01.02 Identify the nature of various types of industrial pollution and some of their effects on the environment.

13.10.01.03 Understand the regulatory framework under which industrial pollutants are controlled.

13.10.01.04 Consider the general methods of air, water and solid waste pollution control.

13.10.01.05 Identify pollutants generated under some specific types of industries and their specific pollution treatment technologies.

13.10.01.06 Conduct influent/effluent analysis including fluid flow, basic piping, components, and volumetric measurements of fluids and effluents.

Competency 13.10.02 Complete the requirements for Hazardous Materials Technician I, II, and III (OSHA 29 CFR 1910.120 (EMOCAP)

13.10.02.01 Follow the procedures identified in the emergency response plan

13.10.02.02 Use personal protective equipment (PPE) appropriate for given situation

13.10.02.03 Identify need for additional resources

13.10.02.04 Follow basic control containment and confinement procedures

13.10.02.05 Follow advanced control containment and confinement procedures

13.10.02.06 Perform assigned role in simulated emergency response situations

13.10.02.07 Function in the role of Incident Command System (ICS) Level II technician

13.10.02.08 Identify the presence of hazardous materials

13.10.02.09 Identify known and unknown hazardous materials and their classifications

13.10.02.10 Demonstrate basic hazard and risk assessment techniques

13.10.02.11 Interpret basic hazardous material terminology

13.10.02.12 Identify symptoms indicating exposure to toxic and nontoxic chemicals

13.10.02.13 Implement decontamination procedures

13.10.02.14 Develop standard operating and termination procedures

13.10.02.15 Terminate procedures

ENVIRONMENTAL PROJECT COORDINATION

Competency 13.11.01 Demonstrate knowledge of environmental project coordination (CSU)

13.11.01.01 Give an overview of the management of environmental engineering projects.

13.11.01.02 Develop an appreciation of the many aspects of project coordination including problem discovery, and definition, investigative techniques, work plans, health and safety plans, agency interfacing/permit acquisition, solicitation of quotes/proposals, and other related tasks will be discussed.

13.11.01.03 Identify and explain the various components of an environmental engineering project, from start to finish.

13.11.01.04 Demonstrate knowledge of the environmental regulatory agencies' permitting processes, and communication skills needed to effectively interface with agency officials.

13.11.01.05 Identify various investigation and remediation techniques utilized in environmental engineering projects.

13.11.01.06 Identify and describe the environmental technician's role in the environmental engineering profession.

ENVIRONMENTAL ASSESSMENT

Competency 13.12.01 Demonstrate knowledge of environmental assessment (CSU)

13.12.01.01 Develop a plan of study for the preparation of an environmental assessment/inventory of a specific site.

13.12.01.02 Develop a listing and contact various governmental agencies which may have resource information applicable to the preparation of an environmental assessment/inventory.

13.12.01.03 Organize and prepare an environmental assessment/inventory of a specific project site.

13.12.01.04 Apply environmental laws and regulations in the preparation of an environmental assessment of proposed construction project on a specific site.

13.12.01.05 Identify adverse impacts and develop a plan of mitigative measures to minimize the adverse effects resulting from the proposed project.

NATURE INTERPRETATION

Competency 13.13.01 Demonstrate interpretive abilities (R)

13.13.01.01 Follow general safety precautions

13.13.01.02 Lead nature hike for a group

13.13.01.03 Prepare an interpretative exhibit or display

13.13.01.04 Present an interpretive slide show

13.13.01.05 Present a program

13.13.01.06 Develop an interpretive publication

13.13.01.07 Lead an interpretive activity

13.13.01.08 Use computerized displays

Competency 13.14.01 Develop interpretive skills (R)

13.14.01.02 Use field guides and keys

13.14.01.03 Operate audiovisual equipment

13.14.01.04 Label a scientific collection

13.14.01.05 Explain folklore and history of area

13.14.01.06 Identify target audience's level of understanding.

13. 14.01.07 Identify interpretive styles

13.14.01.08 Identify interpretive tools and aids

BIOLOGICAL SURVEYING AND MONITORING

Research Skills

Competency 13.15.01 Demonstrate Research Skills (WR)

13.15.01.01 Students will formulate and interpret explanations for the magnitude of diversity at different periods of geologic time and present the results of investigations in a variety of forms.

13.15.01.02 Formulate and interpret explanations for the magnitude of diversity at different periods of geologic time.

13.15.01.03 Present the results of investigations in a variety of forms.

13.15.01.04 Use techniques to collect, analyze and communicate information to develop creativity, knowledge, perspective and competence to increase efficiency and encourage life long learning.

13.15.01.05 Conduct learner developed investigations independently and collaboratively over a period of weeks and months.

13.15.01.06 Scientifically catalogue and photograph scientific specimens found in freshwater and terrestrial environments and present final collection to the class.

Competency 13.15.02 Translate information represented in the form of numbers to graphical representations, tables, charts, graphs, diagrams and geometric figures. (WR)

13.15.02.01 Investigate dynamic equilibrium including biological, mechanical, chemical and others.

13.15.02.02 Translate information represented in the form of numbers to graphical representations, tables, charts, graphs, diagrams and geometric figures.

13.15.02.03 Answer student determined questions by designing databases and drawing inferences from information in these data bases.

13.15.02.04 Utilize field log data to collaboratively construct an ongoing databank of species abundance, climate and chronological data and infer ecological and physical relationships of terrestrial and freshwater organisms in a designated study area.

Competency 13.15.03 Formulate models and hypothesis for models in the natural world. (WR)

13.15.03.01 Formulate models and hypothesis for models in the scientific world.

13.15.03.02 Notice and critically analyze arguments and conclusions of investigations conducted by self.

13.15.03.03 Individually develop presentation of research project and investigations appropriate for a variety of audiences.

13.15.03.04 Seek information from a variety of sources on topics of individual scientific interest.

Competency 13.15.04 Keep journals of observations and inferences made over an extended period of time and reflect upon the impact of these recorded ideas on their thinking and actions. (WR)

13.15.04.01 Coherently demonstrate various logical connections between related concepts.

13.15.04.02 Individually and collaboratively reflect on the ideas and content found in their own journal records.

13.15.04.03 Accept constructive criticism of their work.

13.15.04.04 Keep journals of observations and inferences made over an extended period of time and reflect upon the impact of these recorded ideas on their thinking and actions.

13.15.04.05 Keep a scientific journal of their observations while at the designated study area.

Competency 13.15.05 Identify, compare, and contrast different modes of inquiry, habits of mind, attitudes and dispositions that arise in the world of science by conducting learner developed investigations independently and collaboratively over periods of weeks and months and by investigating physical and chemical changes in living and non-living systems. (WR)

13.15.05.01 Investigate physical and chemical changes in living and non-living systems.

13.15.05.02 Identify, compare, and contrast different modes of inquiry, habits of mind, attitudes and dispositions that arise in the world of science.

13.15.05.03 Present orally (to peers, instructors, and the community) individual investigations using multimedia equipment. Presentations will demonstrate individual and collaborative research in a particular biological and or ecological field.

Competency 13.15.06 Create products, make inferences, and draw conclusions using databases, spreadsheets and other technologies. (WR)

13.15.06.01 Interpret and analyze patterns and relationships in the living environment and the physical setting and communicate the results in various ways.

13.15.06.02 Seek elaboration and justification of data and ideas and reflect on alternative interpretations of the information.

13.15.06.03 Create products, make inference, and draw conclusions using databases, spreadsheets and other technologies.

13.15.06.04 Collaboratively contribute to a data base which includes a species list of species noted and in what abundances. Students will analyze species data and compare annual change describing sources of such change.

Competency 13.15.07 Investigate patterns in nature by designing, collecting information for, and constructing databases that are useful in answering student determined questions and by formulating personal explanations and inferences using verifiable data; then present the results of investigations in a variety of forums. (WR)

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13.15.07.01 Investigate patterns in nature.

13.15.07.02 Present the results of investigations in a variety of forums.

13.15.07.03 Formulate personal explanations and inferences using verifiable data.

13.15.07.04 Students will actively collect a variety of data that will reflect territory, sex determination, behavioral characteristics, and population of a given species. This data will be entered into a database that will answer student determined questions.

Competency 13.15.08 Fulfill responsibilities as part of a research group to recognize his or her own strengths and weakness. (WR)

13.15.08.01 Participate in scientific debates in the classroom, and represent a position on scientific issues. Rely on documented and verified data to develop the position.

13.15.08.02 Fulfill responsibilities as part of a research group.

13.15.08.03 Recognize his or her own strengths and weakness', and develop strategies to overcome the weakness' and optimize the strengths.

Competency 13.15.09 Learn to recognize, value and synthesize the contributions to scientific knowledge and processes from individuals of other cultures by exploring classical scientific literature that investigates principles such as biological evolution, environmental conservation, historical geology or descriptive geology. (WR)

13.15.09.01 Explore classical scientific literature that investigates principles such as biological evolution, environmental conservation, historical geology or descriptive geology.

13.15.09.02 Translate data represented in various forms such as words, numbers, tables, charts, graphs, diagrams, maps, geometric figures, ratios, and equations.

13.15.09.03 Value the scientific thinking of others and self.

13.15.09.04 Recognize, value and synthesize the contributions to scientific knowledge and processes from individuals of other cultures.

13.15.09.05 Summarize assigned readings and prepare to discuss them in small groups. They will record the ideas and thoughts of others and critique constructively the article and its interpretation.

Competency 13.15.10 Individually and collaboratively produce written representations of investigative results and coherently demonstrate various logical connections between related concepts by exploring the everyday nature of science within the home setting. (WR)

13.15.10.01 Explore the structure and functions of living and non - living entities through models and simulations.

13.15.10.02 Coherently demonstrate various logical connections between related concepts.

13.15.10.03 Individually and collaboratively produce written representations of investigative results.

13.15.10.04 Explore the everyday nature of science within the home setting and investigate technologies that define our lifestyles.

Competency 13.15.11 Evaluate wildlife populations (R)

13.15.11.01 Follow general safety precautions

13.15.11.02 Cruise a study area

13.15.11.03 Collect census data

13.15.11.04 Define demographics

13.15.11.05 Assess habitat

13.15.11.06 Evaluate population trends

13.15.11.07 Measure mortality

13.15.11.08 Use satellite tracking

SCIENTIFIC METHOD

Competency 13.15.12 Demonstrate understanding of scientific method (COTP)

13.15.12.01 Describe the role of observation and experimentation in the development of scientific theories.

13.15.12.02 Describe the importance of the use of models in scientific thought.

13.15.12.03 Recognize that scientific models are only representations of phenomena and may in fact be faulty or deficient.

13.15.12.04 Investigate some of the ethical dilemmas of the scientist.

13.15.12.05 Demonstrate the ability to identify and define a scientific problem.

13.15.12.06 Ask appropriate scientific questions and recognize what is involved in experimental approaches to the solutions of such questions through familiarity with laboratory and field work.

13.15.12.07 Identify problems rooted in science and technology.

13.15.12.08 Demonstrate the ability to distinguish among fact, hypothesis, and opinion; the relevant from the irrelevant' and the model from the observations the model was derived to describe.

13.15.12.09 Demonstrate the ability to check the logical consistency of hypothesis with relevant laws, facts, observations, or experiments.

13.15.12.10 Ability to read scientific materials critically.

13.15.12.11 Gather scientific information through library work.

13.15.12.12 Investigate areas of specialization in science.

RESEARCH METHODOLOGY

Competency 13.15.13 Demonstrate understanding of research methodology (COTP)

13.15.13.01 Apply basic scientific and technical solutions to selected problems

13.15.13.02 Demonstrate the ability to employ scientific laws and principles in familiar or unfamiliar situations.

13.15.13.03 Make predictions from data using concepts, laws, and theories.

13.15.13.04 Use facts, concepts, laws, and theories to explain phenomena.

13.15.13.05 Predict the effects of changing variables in a given situation.

13.15.13.06 Demonstrate the ability to suggest or recognize a scientific hypothesis.

13.15.13.07 Construct a hypothetical model.

13.15.13.08 Design and conduct experiments.

13.15.13.09 Make direct measurements using laboratory apparatus.

13.15.13.10 Using the chemical balance for weighing of chemical samples.

13.15.13.11 Design, conduct, and evaluate an experiment.

13.15.13.12 Use sampling techniques.

13.15.13.13 Demonstrate an ability to propose or select validating procedures.

13.15.13.14 Analyze experimental designs.

13.15.13.15 Demonstrate concern for issues related to measurement.

13.15.13.16 Demonstrate the ability to interpret data, i.e., to comprehend the meaning of data and recognize, formulate, and evaluate conclusions and generalizations on the basis of information known or given.

13.15.13.17 Draw conclusions or make inferences from data.

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13.15.13.18 Interpret information presented in pictures, drawings, charts, graphs, mathematical expressions, and scientific literature.

13.15.13.19 Demonstrate an ability to reason quantitatively and symbolically.

13.15.13.20 Interpret observations of experiments and analyze these to determine patterns, state inferences and draw conclusions.

13.15.13.21 Interpret experimental observations using facts, concepts, laws, and theories.

13.15.13.22 Communicate scientific information.

13.15.13.23 Sequence events according to the order of occurrence.

13.15.13.24 Organize and communicate the results obtained by observation and experimentation.

13.15.13.25 Describe ways scientists communicate their results.

13.15.13.26 Demonstrate the ability to summarize empirical findings clearly and concisely in written form.

IDENTIFICATION OF FLORA AND FAUNA

Competency 13.15.14 Identify and classify common animals species (R)

13.15.14.01 Identify mammals and explain their life histories

13.15.14.02 Identify birds and explain their life histories

13.15.14.03 Identify reptiles and explain their life histories

13.15.14.04 Identify amphibians and explain their life histories

13.15.14.05 Identify invertebrates and explain their life histories

13.15.14.06 Identify fish and explain their life histories

Competency 13.15.15 Identify and classify plants (R)

13.15.15.01 Classify plants as monocots or dicots

13.15.15.02 Identify purpose of binomial nomenclature

13.15.15.03 Classify plants as annuals, biennials, or perennial

13.15.15.04 Identify environmental plant preferences

13.15.15.05 Classify plants according to growth habit

13.15.15.06 Identify plants according to scientific names

13.15.15.07 Update endangered species lists

Competency 13.15.16 Examine plant physiology and growth (R)

13.15.16.01 Describe woody and herbaceous plants

13.15.16.02 Identify plant parts

13.15.16.03 Identify photosynthesis process

13.15.16.04 Identify functions of roots, stems, and leaves

13.15.16.05 Identify requirements for healthy plant growth

13.15.16.06 Identify taproot and fibrous root systems

13.15.16.07 Identify differences between evergreen and deciduous plants

Competency 13.15.17 Develop vegetation and revegetation requirements and plans (EMOCAP)

13.15.17.01 Comply with established laws and regulations concerning vegetation and revegetation

13.15.17.02 Conduct vegetation inventories

13.15.17.03 Transplant vegetation

13.15.17.04 Establish test plots

13.15.17.05 Identify nutrient deficiencies of vegetation

13.15.17.06 Maintain revegetated areas

13.15.17.07 Prepare seedbeds

13.15.17.08 Mix seeds

13.15.17.09 Inoculate seeds

ECOLOGICAL PRINCIPLES

Competency 13.16.01 Identify basic ecological principles (R)

13.16.01.01 Identify relationship between communities of an ecosystem

13.16.01.02 Identify major plant biomes

13.16.01.03 Differentiate renewable and nonrenewable resources

13.16.01.04 Identify communities

Competency 13.16.02 Demonstrate basic knowledge of ecosystems and ecological principles (EMAS)

13.16.02.01 Identify the interacting spheres that make up our ecosphere

13.16.02.02 Identify the characteristics of the scientific method

13.16.02.03 Explain the rationale for comparing a controlled system against an uncontrolled system

13.16.02.04 Explain how energy flows through ecosystems

13.16.02.05 Explain how materials are cycled in ecosystems

13.16.02.06 Provide examples of the first and second laws of thermodynamics as they occur in ecosystems

13.16.02.07 Identify the steps in the photosynthesis process

13.16.02.08 Compare and contrast grazing and detritus food webs

13.16.02.09 Identify the ways in which efficiency applies to energy flow in food webs

13.16.02.10 Compare and contrast gross and net photosynthesis

13.16.02.11 Identify the steps in carbon and oxygen cycles

13.16.02.12 Explain the interrelationship of carbon and oxygen cycles

13.16.02.13 Identify the ways in which agricultural systems differ from natural ecosystems

13.16.02.14 Compare and contrast nitrogen and phosphorus cycles

13.16.02.15 Identify the ways in which humans have altered chemical cycles

13.16.02.16 Identify the characteristics of pollution

Competency 13.16.03 Identify ecological responses to environmental change (EMOCAP)

13.16.03.01 Identify the processes governing an organism's ability to respond to and survive

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13.16.03.02 Provide examples of the law of tolerance and the law of the minimum

13.16.03.03 Identify the steps in the process of ecological succession

13.16.03.04 Provide examples of how human activities impact succession

13.16.03.05 Provide examples of types of adaptation

13.16.03.06 Identify micro-organisms used to improve our ecology

Competency 13.16.04 Identify different classifications (COPT)

13.16.04.01 List characteristics of living organisms.

13.16.04.02 Classify common organisms by observable characteristics.

13.16.04.03 Describe how living organisms are classified.

13.16.04.04 List characteristics of organisms in each kingdom.

13.16.04.05 Explain the difference between viruses and bacteria.

Competency 13.16.05 Identify Environmental Interrelationships (COPT)

13.16.05.01 Describe the interrelationship of an organism with its environment, including: pollution, populations, community, conservation, habitat, and ecosystem.

13.16.05.02 Define natural selection and list evidence for its existence.

13.16.05.03 Discuss the development of the concept of evolution.

13.16.05.04 Identify ways to take responsibility for living in a global environment.

13.16.05.05 Explain and present examples of the importance of water to sustain life in terms of available water sources, water quality, and uses and quantification.

13.16.05.06 Explain interrelationship of wastewater collection, treatment, and public health in terms of organic and inorganic pollutant concentrations and pathogenic organisms.

13.16.05.07 Describe how human activities interfere with biological diversity.

Competency 13.16.06 Explain growth processes in natural populations (EMOCAP)

13.16.06.01 Provide example of linear and geometric growth patterns

13.16.06.02 Explain different processes used to measure population growth

13.16.06.03 Differentiate between density-dependent and density-independent regulation of populations

13.16.06.04 Provide examples of predation and parasitism

13.16.06.05 Identify the effects of predation, parasitism, competition, and mutualism on the regulation of the size of natural populations

13.16.06.06 Identify the physical factors controlling population sizes

13.16.06.07 Provide example of the effects of carrying capacity when a species overshoots population limits

Competency 13.16.07 Identify human population dynamics (EMOCAP)

13.16.07.01 Identify the factors that have influenced population growth throughout history

13.16.07.02 Identify the factors influencing population growth in recent times

13.16.07.03 Calculate population doubling time

13.16.07.04 Compare and contrast the age-structure diagrams of the United States and other countries

13.16.07.05 Identify the differences in the effects of a demographic transition on more-developed and less-developed nations

13.16.07.06 Identify the factors that are considered in calculating total fertility growth (TFG)

13.16.07.07 Identify the factors that are considered in calculating zero population growth

13.16.07.08 Explain why population growth occurs even with replacement-level fertility

WETLAND ECOLOGY

Competency 13.17.01 Identify and define wetlands (WM)

13.17.01.01 Describe the history of wetlands and global wetland loss

13.17.01.02 Explain the development of wetland science and the work of wetland scientists

13.17.01.03 Provide an overview of the role of wetland managers

13.17.01.04 Identify and list the distinguishing features of wetlands

13.17.01.05 Discuss the problems associated with defining wetlands

Competency 13.17.02 Differentiate between wetland types (WM)

13.17.02.01 List and describe the major types of wetlands

13.17.02.02 Differentiate between the major wetlands in the United States and Canada

Competency 13.17.03 Describe the wetland environment (WM)

13.17.03.01 Explain the importance of hydrology in wetlands

13.17.03.02 Identify and measure important biogeochemical features of wetlands

13.17.03.03 List and observe biological adaptations to the Wetland Environment

13.17.03.04 Develop working wetland models

Competency 13.17.04 Define and describe the major types of coastal wetland ecosystems (WM)

13.17.04.01 Compare and contrast tidal salt marshes, tidal freshwater marshes and mangrove wetlands

Competency 13.17.05 Define and describe the major types of inland wetland ecosystems (WM)

13.17.05.01 Compare and contrast freshwater marshes, northern peatlands, southern deepwater swamps, and riparian wetlands

Competency 13.17.06 Assess and practice the management of local wetlands (WM)

13.17.06.01 Identify and quantify wetland values

13.17.06.02 Examine the legal protection of wetlands in the United States

13.17.06.03 Define restored and constructed wetlands

13.17.06.04 Observe restored and constructed wetlands

13.17.06.05 Participate in the monitoring and maintaining of wetlands

13.17.06.04 Initiate and participate in wetland inventories

ENVIRONMENTAL POLITICS, LAWS, AND ECONOMICS

Competency 13.18.01 Identify past practices affecting the environment (EMOCAP)

13.18.01.01 Locate regulatory reference materials

13.18.01.02 Access needed information using regulatory reference materials

13.18.01.03 Collect background information

13.18.01.04 Verify the accuracy of information collected

13.18.01.05 Investigate the background of each complaint

13.18.01.06 Interact with various regulatory agencies

Competency 13.18.02 Explain the interplay of politics and economics relative to environmental problems (EMOCAP)

13.18.02.01 Identify the environmental topics included in recently passed legislation

13.18.02.02 Identify the methods governmental agencies use to arrive at decisions affecting the environment

13.18.02.03 Identify the constituencies that politicians must take into consideration before arriving at decisions

13.18.02.04 Explain the reasons why incremental decision making prevails over holistic solutions to problems

13.18.02.05 Identify the competing interests of economists and ecologists

13.18.02.06 Identify the structures and characteristics of free, mixed, and centralized market economies

13.18.02.07 Identify the analytical tools employed by economists in decision making

13.18.02.08 Identify the differences and similarities between environmental problems in the United States and those in foreign, particularly less developed, countries

13.18.02.09 Explain how environmental issues are created and resolved by economic and/or political decisions

13.18.02.10 Identify ways in which humans are an integral part of nature

Competency 13.18.03 Identify and classify nuclear waste (EMAC)

13.18.03.01 Define 4 categories of nuclear waste

13.18.03.02 State method of disposal for each category of nuclear waste

13.18.03.03 Identify locations of storage for each type of nuclear waste

13.18.03.04 Identify factual information relevant to radioactivity and radiation

13.18.03.05 Name the key provisions of the Nuclear Waste Policy Act

13.18.03.06 Identify the key agencies involved in the high-level radioactive waste management program

13.18.03.07 Discuss whether this generation or future generations should provide for disposal of nuclear waste currently in storage

13.18.03.08 Explain the federal role in the management of nuclear waste

13.18.03.09 Identify problems and solutions associated with nuclear waste

13.18.03.10 Differentiate between technical and societal issues related to disposing of nuclear waste.

13.18.03.11 State ways in which people living in a democratic society make decisions about risks related to technology

13.18.03.12 Discuss risk and what can be done to reduce it in learners life

13.18.03.13 Discuss probabilities and risk assessment on an introductory level

Competency 13.18.04 Define and describe C.E.R.C.L.A. (EMAC)

13.18.04.01 List the key parts of C.E.R.C.L.A. site evaluation and remedy selection

13.18.04.02 Explain the 3 scores involved with the Hazard Ranking System

13.18.04.03 Identify 3 National Priority Sites

Competency 13.18.05 Define and describe environmental legislation applicable to C.E.R.C.L.A (EMAC)

13.18.05.01 Identify the components of C.A.A

13.18.05.02 Identify the components of C.W.A.

13.18.05.03 Identify the components of T.S.C.A.

13.18.05.04 Identify components of R.C.R.A.

Competency 13.18.06 Identify and define job related activities to the Occupational Safety and Health Administration (O.S.H.A.) (EMAC)

13.18.06.01 Identify hazardous waste operations and emergency response I.A.W. O.S.H.A. 29 C.F.R. 1910.120

13.18.06.02 Recognize control of hazardous energy (Lockout/Tagout) I.A.W. O.S.H.A. 29 C.F.R. 1910.147

13.18.06.03 Identify commercial diving operations involving the environmental field I.A.W. O.S.H.A. 29 C.F.R.

13.18.06.04 Demonstrate knowledge and understanding of O.S.H.A. 29 C.F.R. 1910.1000 Z Tables

13.18.06.05 Describe O.S.H.A. requirements applicable to blood borne pathogens I.A.W. O.S.H.A. 29 C.F.R. 1910.1200

CARTOGRAPHY

Competency 13.19.01 Conduct a basic survey (EMAC)

13.19.01.01 Measure distance

13.19.01.02 Use and maintain tripod level

13.19.01.03 Read target rod

13.19.01.04 Use and interpret hand signals

13.19.01.05 Record field notes in a field log

13.19.01.06 Determine % and allowable error

13.19.01.07 Calculate acreage

13.19.01.08 Draw a field layout

13.19.01.09 Locate a bench mark

13.19.01.10 Take backsight reading

13.19.01.11 Take foresight reading

13.19.01.12 Perform bench level circuit survey

Competency 13.19.02 Interpret topographic maps (EMAC)

13.19.02.01 Identify legal descriptions

13.19.02.02 Identify map symbols

13.19.02.03 Interpret map legend

13.19.02.04 Determine true and magnetic north

13.19.02.05 Draw a profile using contour lines

13.19.02.06 Identify terrain type

13.19.02.07 Interpret elevation

13.19.02.07 Identify direction of water flow

13.19.02.08 Determine area

Competency 13.19.03 Orient to field position (EMAC)

13.19.03.01	Follow a compass course
13.19.03.02	Locate objects in the field
13.19.03.03	Orient compass to topographic maps
13.19.03.04	Adjust compass to local declination
13.19.03.05	Use back bearings
13.19.03.06	Pace out varying distances
13.19.03.07	Utilize satellite tracking

HEART of OHIO TECH PREP CONSORTIUM

1997

Environmental Technology Model

PART II.B:
Secondary Tech Prep
Academic Competencies (Unleveled)

PREFACE

How to Use This Competency List

The competencies listed in this document are exit competencies for the secondary component of Tech Prep programs. They represent what Tech Prep high school students are expected to be able to do by the end of grade 12.

Information offered in this preface includes:

- Philosophy underpinning Tech Prep academics
- Mathematics education as an example
- Bottom line for Tech Prep academics instruction
- Matrix indicating core and program-specific academic competencies
- Notes on organization of the competency list
- Acknowledgements

Background: What's Different about Tech Prep Academic Competencies?

Tech Prep is a systemic educational reform movement intended to prepare students for the technology-based occupations of the coming century. Here are some key points to know about Tech Prep secondary academics:

- ✓ Tech Prep academics are college preparatory academics for concrete learners. (That's 90% of all of us.)
- ✓ The goal is to prepare Tech Prep students to enter the college of their choice without the need for academic remediation.
- ✓ What makes Tech Prep academics different from traditional college prep academics is not the content. It is the way in which it is taught.

The following section uses *mathematics* as an example to illustrate the necessity for this approach, and some related methodologies.

Mathematics: A Prime Example

If we accept the premise that Tech Prep programs will demonstrate systemic educational change by providing new, creative, and innovative options for students, then we must agree that what has passed for mathematics education in the past will not and can not continue as mathematics education in the future.

The follow excerpts from current literature support this position:

> Evidence from many sources shows that the least effective mode for mathematics learning is the one that prevails in most of America's classrooms: lecturing and listening. Despite daily homework, for most students and most teachers mathematics continues to be primarily a passive activity: teachers prescribe; students transcribe. Students simply do not retain for long what they learn by imitation from lectures, worksheets, or routine homework. Presentation and repetition help students do well on standardized tests and lower-order skills, but they are generally ineffective as teaching strategies for long-term learning, for higher-order thinking, and for versatile problem solving. (National Research Council. Everybody Counts – A Report to the Nation on the Future of Mathematics Education. 1989, p. 57.)

The National Council of Teachers of Mathematics have proposed five general goals for all K-12 students:

> 1. That students learn to value mathematics,
> 2. That students become confident in their ability to do mathematics,
> 3. That students become mathematics problem-solvers,
> 4. That students learn to communicate mathematically, and
> 5. That students learn to reason mathematically....
>
> Toward this end, we see classrooms as places where interesting problems are regularly explored using important mathematical ideas. Our premise is that ***what*** a student learns depends to a great degree on ***how*** he or she has learned it.... This vision sees students studying much the same mathematics currently taught, but with quite a different emphasis. (NCTM. Curriculum and Evaluation Standards for School Mathematics. 1989, p. 5.)

For NCTM's vision for mathematics education to be realized, the vision of how students learn mathematics must shift "toward investigating, formulating, representing, reasoning, and applying a variety of strategies to the solution of problems . . . and away from being shown or told, memorizing and repeating.... {And the] role of teachers toward 'questioning and listening' . . . and away from 'telling' students what to do..." (NCTM, Assessment Standards for School Mathematics,1995, p. 2).

Alternative methods for delivery of mathematics education should address the following:

1. Students should experience mathematics as active, engaging, and dynamic.
2. Mathematics instruction should at all times make appropriate use of technology, especially graphing calculators and computers.
3. Mathematics courses should make extensive use of writing assignments, open-ended projects, and cooperative learning groups.
4. Faculty should use a variety of teaching strategies and should employ a broad range of examples.

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(Mathematical Sciences Education Board. Expectations for Mathematics Education from High School through Career.)

The Bottom Line for Teaching

As shown above, we can not continue to teach mathematics — or for that matter, any high school academics — the way they have always been taught. The Heart of Ohio Tech Prep Consortium officially encourages the kind of systemic change spelled out in the example just presented using mathematics education.

In other words, TECH PREP HIGH SCHOOL ACADEMIC INSTRUCTION SHOULD --

- ☞ **Focus on developing critical thinking and problem-solving skills**
- ☞ **Incorporate cooperative learning techniques**
- ☞ **Include written group projects, developed in conjunction with business and industry, that address real-world problems**
- ☞ **Actively embrace career development and school-to-work opportunities**
- ☞ **Encourage global thinking and learning through multidisciplinary instruction, projects, and experiences**

Core Academic Competencies and Program-Specific Competencies

The matrix on the next page shows--

1. Core competencies required of ALL TECH PREP STUDENTS by the time they complete high school.
2. Program-specific competencies required by the end of grade 12 FOR STUDENTS WHO SELECT A PARTICULAR TECH PREP SECONDARY PROGRAM that is linked with one or more college Tech Prep programs.

Important notes:

- ✔ The grade and sequence in which Tech Prep academic competencies are taught are up to the local school (though in some cases, this is determined naturally by progression of prerequisite skills).
- ✔ Regardless of the sequence, every student completing a high school Tech Prep program should have attained the academic competencies

(both core and program-specific) by the time he or she completes the high school Tech Prep program.

✔ The core competencies and program-specific competencies required by the end of grade 12 are the minimum requirements for successful completion of the high school Tech Prep program and subsequent matriculation into a college Tech Prep program. If time and resources allow, any school may choose to enrich its Tech Prep programs by teaching additional competencies that enhance the students' college and/or employment readiness.

✔ Instructors will notice that competencies listed in their discipline are generally equivalent to the college prep content they already teach (e.g., Algebra I, Geometry, Biology, Global History, etc.).

✔ Schools are advised to retain traditional names for academic courses (e.g., Algebra II, English IV) on the student's official transcript, to support their acceptance by selective-admissions colleges and universities, as well as for scholarship eligibility (e.g., NCAA). Although schools may organize and sequence Tech Prep academic course content differently from traditional college preparatory courses, students should have attained all of the requisite competencies by the end of grade 12, thereby addressing the expectations of these organizations.

MATRIX NO. 1:
CORE ACADEMIC COMPETENCIES REQUIRED OF ALL TECH PREP STUDENTS BY THE END OF GRADE 12

ACADEMIC COMPETENCIES				Individual Development Competencies	Technology Literacy Competencies	Professional Options (Technical & Employability Competencies)
Communications Literacy*	Mathematics Literacy*	Science Literacy*	Social/Cultural Literacy*			
All competencies listed	• Algebra • Numbers & number relations • Data analysis & probability	• Lab safety procedures • Scientific process • Biology/ecology	All competencies listed	All competencies listed	All competencies listed	See specific program model (separate document)
*Four years of college-prep English	*Minimum three years of college prep mathematics -- see Matrix No. 2 for additional program-specific requirements	*Minimum two years of lab science, one of which is biology — see Matrix No. 2 for additional program-specific requirements	*Four years of college-prep humanities			

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MATRIX NO. 2:
ADDITIONAL ACADEMIC COMPETENCIES REQUIRED FOR SPECIFIC TECH PREP PROGRAMS IN GRADES 11-12*

(*In addition to core competencies required of all students)

TECH PREP PROGRAM MODEL (Gr. 11-12)	Mathematics Literacy Competencies*	Science Literacy Competencies*	Professional Options Competencies (Technical & Employability)
Automotive/Diagnostic Technologies	• Geometry • Technical Algebra	• Chemistry • Physics	See separate program model documentation
Business Technologies Core Model:			
■ Computerized Business Technology (CBT) Career Major	• Geometry • Technical Algebra	• Chemistry or Physics *(recommended but not required)*	See separate program model documentation
■ Business Management Career Major *(in process)*	TBA	TBA	TBA
Construction Technologies	• Technical Algebra • Geometry and/or Technical Trigonometry *(recommended but not required)*	• Physics • Chemistry *(recommended by not required)*	See separate program model documentation
Engineering Technologies Core Model:			
■ Architecture/ Construction Career Major	Select two: • Technical Algebra • Geometry • Technical Trigonometry	• Chemistry • Physics	See separate program model documentation

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MATRIX NO. 2:
ADDITIONAL ACADEMIC COMPETENCIES REQUIRED FOR SPECIFIC TECH PREP PROGRAMS IN GRADES 11-12*

(*In addition to core competencies required of all students)

TECH PREP PROGRAM MODEL (Gr. 11-12)	Mathematics Literacy Competencies*	Science Literacy Competencies*	Professional Options Competencies (Technical & Employability)
Engineering Core Model program, continued:	Select two: • Technical Algebra • Geometry • Technical Trigonometry	• Chemistry • Physics	See separate program model
▪ Design Engineering Career Major			
▪ Electronics Technology Career Major			
▪ Graphic Communications Career Major			
▪ Landscape Career Major			
▪ Manufacturing Career Major			
Environmental Technologies	• Geometry • Technical Algebra	• Chemistry • Environmental Geology *(specific to this program; see separate program model documentation)*	See separate program model documentation
Information Engineering Technologies	• Geometry • Technical Algebra	• Chemistry • Physics	See separate program model documentation
Multi-Competency Health Technologies ("Allied Health")	• Technical Algebra	• Chemistry	See separate program model documentation

Notes on Organization of the Competency List

- Numbering format:
  - Category
    - Subcategory
      - Competency (*9.03.12.00)
        - Competency Builder (9.03.12.11)

- An asterisk (*) indicates that the statement is a competency. Others are competency builders. Competency statements always end with ".00" in the builder columns.

- Categories:

1 = Communications Literacy	47 competencies
2 = Individual Development	11 competencies
3 = Mathematics Literacy	30 competencies
4 = Science Literacy	16 competencies
5 = Social/Cultural Literacy	21 competencies
6 = Technology Literacy	26 competencies
	151 total

- Professional Options (technical) competencies are not included. The set of specific technical competencies used will depend on the particular Tech Prep program model. These are contained in separate documents available from each school's representative to the Tech Prep Consortium Implementation Committee.

- Communications Literacy competencies do not include builders.

- Individual Development category does not include subcategories.

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COMMUNICATIONS LITERACY COMPETENCIES

Effective Reading Skills

*1.01.01.00 Differentiate between fact, opinion, and inference.

*1.01.02.00 Cite details that support or do not support predictions.

*1.01.03.00 Recognize the intent and use of propaganda.

*1.01.04.00 Identify and summarize ideas, information, and events that are explicitly stated in written material.

*1.01.05.00 Explain the sequence of time, places, events, and ideas.

*1.01.06.00 Identify and explain the main and subordinate ideas (stated or implied) in a written work.

*1.01.07.00 Apply interpretive level comprehension skills to generate ideas and/or hypotheses about the content.

*1.01.08.00 Find, understand, interpret, and apply information from a variety of sources (books, manuals, newspapers, periodicals, directories, reference works, computer printouts, and electronic sources).

*1.01.09.00 Use the features of books and reference materials, such as table of contents, preface, introduction, titles and subtitles, index, glossary, appendix, and bibliography.

*1.01.10.00 Define and use unfamiliar words and specialized vocabulary (including abbreviations, acronyms, concepts, and jargon) by using structural analysis, decoding, contextual cues, dictionaries, and computers.

*1.01.11.00 Read and understand short notes, memos, letters, and forms.

*1.01.12.00 Read and follow complex directions.

*1.01.13.00 Determine the author's purpose.

*1.01.14.00 Read, evaluate, and respond critically to various literature forms, genres, and printed media.

*1.01.15.00 Recognize and interpret organizational patterns of writing (e.g., cause and effect, comparison and contrast, and simple listing).

*1.01.16.00 Identify the structural elements of literature (e.g., plot, theme, character, mood, setting, and point of view).

*1.01.17.00 Identify literary devices (e.g., metaphor, foreshadowing, flashback, allusion, satire, and irony).

*1.01.18.00 Explore and analyze a variety of cultural elements, attitudes, beliefs, and value structures through reading.

Effective Speaking and Presentation Skills

*1.02.01.00 Give oral directions and clear explanations.

*1.02.02.00 Participate critically and constructively in the exchange of ideas, particularly during class discussions and conferences with individuals.

*1.02.03.00 Demonstrate correct usage of vocabulary.

*1.02.04.00 Demonstrate an awareness and understanding of interpersonal communication skills (verbal and nonverbal) in one-to-one and small group settings (role playing).

*1.02.05.00 Speak effectively using nonverbal communication such as eye contact, posture, and gestures.

*1.02.06.00 Select topics suitable to audience, situation, and purpose.

*1.02.07.00 Demonstrate effective speaking skills in seeking employment and in utilizing management skills on the job.

*1.02.08.00 Give formal and informal talks and speeches.

*1.02.09.00 Demonstrate the difference between informing and persuading and use the appropriate techniques of content and delivery for each purpose.

*1.02.10.00 Use visual media.

*1.02.11.00 Demonstrate proper telephone etiquette.

Effective Writing Skills

*1.03.01.00 Demonstrate ability to use different forms of writing (e.g., literary response, business and technical communicative modes, personal responses, journals, research and recording).

*1.03.02.00 Demonstrate appropriate selection of mode, purpose, audience, point of view, and organization of information in written assignments.

*1.03.03.00 Demonstrate expertise in word processing, graphics, and/or desktop publishing aids for writing.

*1.03.04.00 Apply writing process techniques: 1) Prewriting, 2) Drafting, 3) Revising, 4) Editing/proofreading, 5) Publishing.

*1.03.05.00 Demonstrate ability to evaluate written assignments using a diagnostic rubric.

*1.03.06.00 Develop and maintain a professional writing portfolio.

Listening Skills

*1.04.01.00 Follow spoken directions.

*1.04.02.00 Distinguish between fact and opinion.

*1.04.03.00 Make inferences and draw conclusions from verbal and nonverbal messages.

*1.04.04.00 Identify and comprehend the main-and subordinate ideas in lecture and discussions, questions to clarify information heard, and report accurately what others have said.

*1.04.05.00 Restate or paraphrase a conversation to confirm one's own understanding of what was said.

*1.04.06.00 Take accurate notes which summarize material presented from spoken conversations, including telephone messages.

*1.04.07.00 Recognize multi-cultural differences when listening.

Critical Viewing/Graphic/Observation Skills

*1.05.01.00 Read and understand graphs, charts, and tables to obtain factual information.

*1.05.02.00 Produce and utilize effective communication skills in the development of graphs, tables, and charts to communicate ideas.

*1.05.03.00 Critically view historical or contemporary events, via TV or video tape, and make appropriate observations.

*1.05.04.00 Analyze the effects of advertising and other visual media for direct and hidden messages, including propaganda devices.

*1.05.05.00 Communicate through use of video tape and computer presentations.

INDIVIDUAL DEVELOPMENT

*2.00.01.00 Apply critical thinking skills to personal, family, and work problems for the well-being of self and others

2.00.01.01 Differentiate between facts and assumptions.

2.00.01.02 Develop inferences from data.

2.00.01.03 Demonstrate an ability to evaluate arguments.

2.00.01.04 Utilize deductive logic by predicting specific phenomena from general statements.

*2.00.02.00 Apply problem-solving process to personal, family, and work-related problems for well-being of self and others

2.00.02.01 Analyze and clarify own value structure.

2.00.02.02 Evaluate the relationship between values and goals

2.00.02.03 Establish priorities for short and long-term goals

2.00.02.04 Describe the importance of flexibility when reevaluating goals

2.00.02.05 Manage resources to achieve goals

2.00.02.06 Identify adequate reliable information and resources for personal, family, and work-related problem solving.

2.00.02.07 Create solutions to problems using technical means

2.00.02.08 Compare and contrast the advantages and disadvantages of several solutions to a problem.

2.00.02.09 Evaluate outcomes of a decision.

2.00.02.10 Apply decision-making techniques in the workplace

2.00.02.11 Apply technical problem solving abilities and creative talents to situations in the workplace

*2.00.03.00 Assume a leadership role as a responsible family member and citizen

2.00.03.01 Evaluate leadership styles appropriate for the workplace and/or home

2.00.03.02 Identify ways to be a responsible citizen at home, at school, at work, and in community settings

2.00.03.03 Develop effective communication skills.

2.00.03.04 Determine ways to motivate others

2.00.03.05 Demonstrate initiative to facilitate cooperation

*2.00.04.00 Build and maintain constructive interpersonal relationships

2.00.04.01 Assess and be sensitive to others' feelings and point of view

2.00.04.02 Examine how individuals from various backgrounds contribute to work and personal situations

2.00.04.03 Identify ways to work cooperatively with others of diverse background

2.00.04.04 Analyze strategies to manage conflict

2.00.04.05 Cooperate and compromise through teamwork and group participation

2.00.04.06 Develop communication patterns that enhance family relationships

2.00.04.07 Identify characteristics of love and commitment with family, friends, and others

2.00.04.08 Understand ways to build and maintain strong, functional families

2.00.04.09 Understand ways to build positive parent-child relationships

2.00.04.10 Enhance personal development of self and others throughout the lifespan

2.00.04.12 Develop a life-management plan

*2.00.05.00 Develop skills to successfully cope with changes taking place in society.

2.00.05.01 Analyze the effects of change

2.00.05.02 Identify strategies for dealing with family change and stress

2.00.05.03 Identify family and work support resources and services

2.00.05.04 Evaluate the need for continuing education and training

2.00.05.05 Implement strategies to manage the effects of stress

*2.00.06.00 Identify management strategies for balancing work and family roles and responsibilities

2.00.06.01 Analyze the effects of work on family

2.00.06.02 Analyze the effects of family on work

2.00.06.03 Describe personal and family roles and issues

2.00.06.04 Identify present and future family structures and responsibilities

2.00.06.05 Analyze concerns of working parent(s)

2.00.06.06 Evaluate importance of responsible parenting for individuals, families, and society

2.0.0.06.07 Coordinate personal and career responsibilities for well-being of self and others

*2.00.07.00 Develop strategies for lifelong career planning

2.00.07.01 Assess knowledge, attitudes, skills, and aspirations

2.00.07.02 Develop an awareness of careers and skills in a technological society.

2.00.07.03 Complete and process job application forms

2.00.07.04 Design a resume

2.00.07.05 Demonstrate interviewing skills

2.00.07.06 Compare and evaluate job opportunities

2.00.07.07 Analyze organizational structures of the workplace

2.00.07.08 Assess factors influencing wages, annual incomes, and job opportunities

2.00.07.09 Identify strategies for keeping a job, advancing in a job, and increasing wages

2.00.07.10 Evaluate factors involved when assuming a new position within or outside an occupation/ organization

2.00.07.11 Identify strategies for dealing with career successes, changes, and/or disappointments

2.00.07.12 State the approximate number of years a person can expect to work after leaving high school.

2.00.07.13 Compare the advantages and disadvantages of multiple incomes

2.00.07.14 Analyze opportunities for personal and career growth

2.00.07.15 Evaluate career choices in relation to life-management plan

2.00.07.16 Formulate plan to achieve career goals

*2.00.08.00 Develop habits and attitudes that reflect an appropriate work ethic.

2.00.08.01 Analyze the value of work ethic in relation to personal and family values and goals

2.00.08.02 Evaluate the relationship of self-esteem to work ethic

2.00.08.03 Follow directions.

2.00.08.04 Identify strategies to improve workplace policies and attitudes that support individuals and families.

2.00.08.05 Develop a positive attitude

2.00.08.06 Develop time management skills.

*2.00.09.00 Establish a plan for using resources to meet individual and family needs and goals

2.00.09.01 Analyze consumer rights and responsibilities

2.00.09.02 Make informed consumer choices for the well-being of self and others

2.00.09.03 Discuss the role of competitiveness in a global society.

2.00.09.04 Make decisions related to selecting, obtaining, and maintaining clothing for self and family

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2.00.09.05 Evaluate financial institutions and services (e.g., savings, investments, credit).

2.00.09.06 Plan strategies to facilitate self-responsibility in managing a financial plan

*2.00.10.00 Evaluate entrepreneurship as a career option

2.00.10.01 Evaluate the role of small business in the economy

2.00.10.02 Analyze opportunities for new business.

2.00.10.03 Examine considerations of starting a business

2.00.10.04 Analyze responsibilities involved in managing a business .

2.00.10.05 Examine factors involved in obtaining financing.

2.00.10.06 Examine importance of effective record keeping.

2.00.10.07 Examine factors involved in selecting a business location.

2.00.10.08 Analyze importance of a customer service policy.

2.00.10.09 Analyze how laws affect small business operations.

2.00.10.10 Examine components of a marketing plan.

2.00.10.11 Analyze importance of a business plan.

*2.00.11.00 Make choices that promote wellness and good health for self and others

2.00.11.01 Describe the significance of a healthy lifestyle

2.00.11.02 Analyze interrelationship between food choices and wellness

2.00.11.03 Identify strategies to promote optimal nutrition and wellness of individuals and families

2.00.11.04 Prepare and serve nutritious foods

2.00.11.05 Demonstrate proper use of equipment

2.00.11.06 Maintain safe work and home environment

2.00.11.07 Identify substance use, abuse, and its effects on individuals, families, work and society.

2.00.11.08 Enhance self-esteem of self and others

2.00.11.09 Distinguish between responsible and irresponsible ways to express emotional and physical intimacy

2.00.11.10 Examine the role of the arts in cultural expression and identity.

2.00.11.11 Explore the significance of a variety of art forms.

MATHEMATICS-LITERACY

Algebra

*3.01.01.00 Solve linear equations.

3.01.01.01 Combine like terms.

3.01.01.02 Use the Distributive Property to remove grouping symbols and the Addition/Subtraction Property to combine like terms to simplify expressions.

3.01.01.03 Solve equation in one variable utilizing one operation.

3.01.01.04 Solve equations in one variable utilizing two or more operations.

3.01.01.05 Describe and use the logic of equivalence in working with equations, inequalities, and functions.

3.01.01.06 Identify variables, constants, terms, e expressions, and coefficients.

3.01.01.07 Define absolute value.

3.01.01.08 Evaluate algebraic expressions.

3.01.01.09 Solve the literal equation or formula for a specified variable.

3.01.01.10 Recognize the properties of equalities.

3.01.01.11 Solve a 2x2 system of linear equations by elimination.

3.01.01.12 Solve a 2x2 system of linear equations by substitution.

3.01.01.13 Apply the rules for solving linear equations in one variable.

3.01.01.14 Use formulas.

3.01.01.15 Use handheld graphic calculators to solve linear equations and graph simple functions.

3.01.01.16 Solve linear equations in one variable containing an absolute value symbol.

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*3.01.02.00 Use properties of exponents.

- 3.01.02.01 Define exponent.
- 3.01.02.02 Compare and compute using scientific notation.
- 3.01.02.03 Determine values for the square root of any natural number.
- 3.01.02.04 Determine the principal square root and recognize square roots of negatives as being non-real.
- 3.01.02.05 Divide terms having factors with exponents.
- 3.01.02.06 Multiply and divide polynomial expressions.
- 3.01.02.07 Operate with radicals and leave the result in simplified form.
- 3.01.02.08 Apply the properties of exponents to simplify polynomial expressions.
- 3.01.02.09 Multiply terms having factors with exponents.
- 3.01.02.10 Solve radical equations.

*3.01.03.00 Factor a polynomial of two or more terms.

- 3.01.03.01 Apply the distributive law in removing common factors.
- 3.01.03.02 Factor difference of two squares.
- 3.01.03.03 Factor quadratic trinomials.
- 3.01.03.04 Factor the sum and differences of perfect cubes.

*3.01.04.00 Solve linear inequalities and show the solution on a number line.

- 3.01.04.01 Combine like terms.
- 3.01.04.02 Use the Substitution Property to evaluate expressions and formulas.
- 3.01.04.03 Evaluate algebraic expressions.
- 3.01.04.04 Use the Distributive Property to remove grouping symbols and the Addition/Subtraction Property to combine like terms to simplify expressions.

3.01.04.05 Identify variables, constants, terms, expressions, and coefficients.

3.01.04.06 Solve equations in one variable utilizing two or more operations.

3.01.04.07 Describe and use the logic of equivalence in working with equations, inequalities, and functions.

3.01.04.08 Solve a linear inequality in one variable using two or more operations.

3.01.04.09 Define absolute value.

3.01.04.10 Solve problems involving statements of inequality.

*3.01.05.00 Recognize, relate, and use the equivalent ideas of zeros of a function, roots of an equation, and solution of an equation in terms of graphical and symbolic representations.

3.01.05.01 Apply the distributive law in removing common factors.

3.01.05.02 Factor the difference of two squares.

3.01.05.03 Factor quadratic trinomials.

3.01.05.04 Combine like terms.

3.01.05.05 Use the Distributive Property to remove grouping symbols and the Addition/Subtraction Property to combine like terms to simplify expressions.

3.01.05.06 Solve equation in one variable utilizing one operation.

3.01.05.07 Solve equations in one variable utilizing two or more operations.

3.01.05.08 Describe and use the logic of equivalence in working with equations, inequalities, and functions.

3.01.05.09 Identify variables, constants, terms, expressions, and coefficients.

3.01.05.10 Explore and describe characterizing features of functions.

3.01.05.11 Find X and Y intercepts of a line.

3.01.05.12 Decide whether or not a relation is a function. Use function notation. Find domains and ranges.

*3.01.06.00 Graph equations.

- 3.01.06.01 Develop graphical techniques of solution for problem situations involving functions
- 3.01.06.02 Explore and describe characterizing features of functions.
- 3.01.06.03 Describe problem situations by using and relating numerical, symbolic, and graphical representations
- 3.01.06.04 Use the language and notation of functions in symbolic and graphing settings.
- 3.01.06.05 Find X and Y intercepts of a line.
- 3.01.06.06 Write equations for a line.
- 3.01.06.07 Use a graphing calculator or computer to generate the graph of EL function.
- 3.01.06.08 Graph a linear equation using the slope-intercept method.
- 3.01.06.09 Translate among tables, algebraic expressions, and graphs of functions
- 3.01.06.10 Estimate shape of graphs of various functions and algebraic expressions.
- 3.01.06.11 Use handheld graphic calculators to solve linear equations and graph simple functions.
- 3.01.06.12 Graph basic functions using Cartesian coordinate system.

*3.01.07.00 Demonstrate the ability to translate statements and equations from written to algebraic form and algebraic to written form.

*3.01.08.00 Determine slope midpoint, and distance.

- 3.01.08.01 Solve problems related to sets of points on a Cartesian coordinate system.

*3.01.09.00 Model real-world phenomena with polynomial and exponential functions.

- 3.01.09.01 Use curve fitting to predict from data.

Geometry

(Note: It is appropriate to teach geometry to Tech Prep students with some theorems and proofs, but for maximum student engagement and success, the major focus should be on the more practical aspects of geometry, such as calculating volumes, surfaces, etc.)

*3.02.01.00 Find perimeters, surface areas and volumes of geometric figures.

    3.02.01.01 Recognize and classify two- and three-dimensional figures (e.g., circles, triangles, rectangles, cylinders, prism).

    3.02.01.02 Create and interpret drawings of three-dimensional objects.

    3.02.01.03 Classify, label, and describe polygons and solids.

    3.02.01.04 Represent problem situations with geometric models and apply properties of figures.

    3.02.01.05 Use handheld graphic calculators to solve area and volume problems.

    3.02.01.06 Given the linear dimensions of various geometric shapes common to the techno-- logical industries, determine areas and volumes in English and metric units.

*3.02.02.00 Explore compass and straight edge constructions in the context of geometric theorems.

*3.02.03.00 Recognize, classify, and use properties of lines and angles.

    3.02.03.01 Demonstrate an understanding of angles and parallel and perpendicular lines.

    3.02.03.02 Define terms related to angles.

    3.02.03.03 Make constructions related to angles.

    3.02.03.04 Demonstrate an understanding of special angles.

    3.02.03.05 Understand the various units of measure of angles.

    3.02.03.06 Identify points, lines, and planes.

    3.02.03.07 Use the concept of between-ness.

    3.02.03.08 Measure angles correctly.

*3.02.04.00 Describe and apply the properties of similar and/or congruent figures.

  3.02.04.01 Be able to make scale drawings.

*3.02.05.00 Solve right-triangle problems.

  3.02.05.01 Apply the Pythagorean theorem.

  3.02.05.02 Identify basic functions of sine, cosine, and tangent

  3.02.05.03 Compute and solve problems using basic trig functions.

*3.02.06.00 Demonstrate inductive and deductive reasoning through application to various subject areas.

  3.02.06.01 Demonstrate an understanding of and ability to use proof.

Numbers and Number Relations

*3.03.01.00 Estimate answers, compute, and solve problems involving real numbers.

  3.03.01.01 Round off decimals to one or more places

  3.03.01.02 Round and/or truncate numbers to designated place value.

  3.03.01.03 Round off single and multiple digit whole numbers.

  3.03.01.04 Estimate measurements.

  3.03.01.05 Use mental computation when computer and calculator are inappropriate.

*3.03.02.00 Compare and contrast the real number system, the rational number' system' and the whole number system.

*3.03.03.00 Determine if a solution to a mathematical problem is reasonable (estimate).

*3.03.04.00 Select and compute using appropriate units of measure.

  3.03.04.01 Convert, compare, and compute with common units of measurement within and/or across measurement systems.

Data Analysis and Probability

- *3.04.01.00 Collect and organize data into tables, charts, and graphs.
  - 3.04.01.01 Take a random sample from a population.
- *3.04.02.00 Determine the probability of an event.
  - 3.04.02.01 Determine the probability of more than one event.
  - 3.04.02.02 Use computer simulations and random number generation to estimate probability.
- *3.04.03.00 Understand and apply measures of central tendency, variability, and correlation.
  - 3.04.03.01 Compute and interpret means (averages).
  - 3.04.03.02 Compute and interpret median and/or mode.
  - 3.04.03.03 Understand what a normal distribution is.
  - 3.04.03.04 Understand what a uniform distribution is.

Technical Algebra

- *3.05.01.00 Evaluate and graph functions using rectangular coordinates.
  - 3.05.01.01 Graph inequalities in two variables.
  - 3.05.01.02 Analyze the effects of parameter changes on graphs.
- *3.05.02.00 Solve systems of linear equations and inequalities using matrices, graphs, and algebraic methods.
  - 3.05.02.01 Solve systems of linear equations with up to three variables.
  - 3.05.02.02 Solve a 2x2 system of linear equations using matrices.
  - 3.05.02.03 Describe and solve algebraic situations with matrices.

*3.05.03.00 Understand the complex number system and exhibit facility with its operation.

3.05.03.01 Solve problems having complex solutions.

3.05.03.02 Examine complex numbers as zeros of functions.

3.05.03.03 Graph basic functions using polar coordinate system.

3.05.03.04 Graph using polar coordinates.

3.05.03.05 Contrast and compare algebras of rational, real, and complex numbers with characteristics of a matrix algebra system.

3.05.03.06 Determine factors and roots of a polynomial with complex roots.

3.05.03.07 Graph complex numbers.

3.05.03.08 Add, subtract, multiply and divide complex numbers in rectangular and polar form.

3.05.03.09 Convert complex numbers from rectangular form to the exponential.

*3.05.04.00 Analyze exponential and logarithmic functions.

3.05.04.01 Identify and define inverse functions.

3.05.04.02 Do calculations involving exponential and logarithmic expressions and functions.

3.05.04.03 Use definitions to show the relationship between exponential and logarithmic functions.

3.05.04.04 Graph the logarithmic and exponential functions.

3.05.04.05 Describe and use inverse relationship between functions including exponential and logarithmic.

3.05.04.06 Use graphing calculators to generate tables to plot exponential and logarithmic curves.

3.05.04.07 Use properties of logarithms to solve problems.

3.05.04.08 Use graphing calculators to calculate logarithms in bases other than 10.

3.05.04.09 Solve elementary logarithmic and exponential equations.

*3.05.05.00 Simplify and solve quadratic equations.

3.05.05.01 Simplify algebraic expressions and multiply and divide polynomials along with solving quadratic equations.

3.05.05.02 Solve a quadratic equation by factoring by completing the square, and by using the quadratic formula.

Technical Trigonometry

*3.06.01.00 Solve problems using the trigonometric functions.

3.06.01.01 Know the sign of each circular function in any quadrant.

3.06.01.02 Know the circular functions of the special angles, pi/6, pi/4, pi/3 (30, 60, 90)

3.06.01.03 Define the circular functions on a circle of radius r with the center at the origin.

3.06.01.04 Understand the relationship of the circular functions and the trig functions.

3.06.01.05 Identify and use the trig functions for the sum of angles.

3.06.01.06 Solve right-triangle problems.

3.06.01.07 State the value of the trig functions of an angle using the reference angle.

3.06.01.08 Apply the law of sines to find measures of sides of angles of a triangle.

3.06.01.09 Apply the law of cosines in finding measures of sides and angles of triangles.

3.06.01.10 Convert between radians and degrees.

3.06.01.11 Solve problems with negative rotations.

3.06.01.12 Solve right triangle problems including application problems.

*3.06.02.00 Recognize and identify graphs of the trigonometric functions.

  3.06.02.01 Recognize and graph basic trig curves.

  3.06.02.02 Explore graphs in three dimensions.

  3.06.02.03 Identify and define inverse functions.

  3.06.02.04 Solve trigonometric equations and verify trigonometric identities.

  3.06.02.05 Use the fundamental trig identities in performing operations.

*3.06.03.00 Demonstrate an understanding in the use of vectors.

  3.06.03.01 Apply vectors in problem solutions

  3.06.03.02 Deduce properties of figures using vectors.

  3.06.03.03 Develop and use vectors to represent distance and magnitude including operations.

  3.06.03.04 Explore relationships between complex numbers and vectors.

  3.06.03.05 Add and subtract vectors geometrically.

  3.06.03.06 Use graphing calculators in the study of vectors.

SCIENCE LITERACY

Chemistry

*4.01.01.00 Explore atomic theory and present findings using various representational formats.

4.01.01.01 Describe a mechanism of bond formation and identify the type of chemical bond formed as ionic, covalent, or metallic.

4.01.01.02 Relate the concept of periodicity to atomic properties and the periodic table of elements.

4.01.01.03 Describe charge and ionic compounds in the context of electrochemical theories.

4.01.01.04 Recognize that the atomic model is only a model and, like any model, is subject to change.

4.01.01.05 State an atomic theory which includes atomic structure, components and their properties, interactions (electron/nuclear) and theory models.

4.01.01.06 Demonstrate knowledge of chemical symbolism which will include symbols, formulas, and equations.

*4.01.02.00 Perform investigations that require observations over varying periods of time concerning the interrelationship of matter and energy.

4.01.02.01 State a scheme of matter which includes elements, compounds, and mixtures.

4.01.02.02 Relate a chemical equation to the concept of chemical change.

4.01.02.03 Classify matter according to properties and composition.

4.01.02.04 Predict the properties of matter based on data provided in pictures, drawings, charts, graphs, tables, mathematical expressions, and scientific literature.

4.01.02.05 Describe the conservation laws and correctly use the standard units for these laws in relation to conservation of mass/energy and conservation of charge.

4.01.02.06 Describe properties of carbon and organic molecules.

4.01.02.07 State the laws of chemical combinations (conservation of mass, definite composition, multiple proportions).

4.01.02.08 List assumptions of the kinetic theory of matter.

4.01.02.09 Understand chemical changes during combustion, and the relationship between these changes and the carbon cycle, and relationship to the greenhouse effect.

4.01.02.10 Manipulate data in problem solving, including: mole problems, concentration problems, gas law problems, atomic/molecular structure problems and equation balancing.

4.01.02.11 Discuss the concept of mole.

4.01.02.12 State the properties of gases and the laws that apply to gases.

4.01.02.13 Identify applications of Avogadro's hypothesis such as Avogadro's number, molar volume, and gram molecular weight/molar mass.

4.01.02.14 Use the kinetic molecular theory to explain states of matter, rates of reaction, and chemical equilibrium.

4.01.02.15 Describe Stoichiometric relationships

Biology/Ecology

*4.02.01.00 Using models and explorations, examine cellar components and their relationships.

4.02.01.01 Describe the cell theory; structure and function.

4.02.01.02 Describe the role of nucleic acids in cell functions and heredity.

4.02.01.03 Describe the events of mitosis and meiosis.

4.02.01.04 State Mendel's laws of heredity.

4.02.01.05 List causes and effects of gene mutations and chromosomal aberrations.

4.02.01.06 Describe current advances in genetic engineering and possible applications in agriculture and medicine.

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*4.02.02.00 Recognizing and contrasting biological characteristics, derive a scheme to classify living organisms.

4.02.02.01 List characteristics of living organisms.

4.02.02.02 Classify common organisms by observable characteristics.

4.02.02.03 Describe how living organisms are classified.

4.02.02.04 List characteristics of organisms in each kingdom.

4.02.02.05 Explain the difference between viruses and bacteria.

*4.02.03.00 Formulate an understanding of the relationship about organisms, their physical surroundings and their change processes.

4.02.03.01 Describe the interrelationship of an organism with its environment, including: pollution, populations, community, conservation, habitat, and ecosystem.

4.02.03.02 Define natural selection and list evidence for its existence.

4.02.03.03 Discuss the development of Darwin's theory of evolution.

4.02.03.04 Discuss hypotheses of the origin of life.

4.02.03.05 Identify ways to take responsibility for living in a global environment

4.02.03.06 Explain and present examples of the importance of water to sustain life in terms of available water sources, water quality, and uses and quantification.

4.02.03.07 Explain interrelationship of wastewater collection, treatment, and public health in terms of organic and inorganic pollutant concentrations and pathogenic organisms.

4.02.03.08 Describe how human activities interfere with biological diversity.

*4.02.04.00 Using an understanding of life processes, formulate explanations of the influences and the effects of other organisms on the living condition.

4.02.04.01 Explain the relationship between microorganisms and disease .

4.02.04.02 Describe the following life processes: digestion, transpiration, respiration, circulation, reproduction, locomotion, excretion, sensory, regulation by endocrine glands, metabolism, and photosynthesis

4.02.04.03 Distinguish between myths and realities of the HIV virus and AIDS.

4.02.04.04 Explain the relationship between anatomical structure and function.

4.02.04.05 Identify structures in human physiology

Physics

*4.03.01.00 Analyze changes within a system when inputs, outputs, and interactions are altered to explain the behavior of charges.

4.03.01.01 Describe electrical energy, including the interaction of matter and energy and energy transformation.

4.03.01.02 Describe the properties of magnetic fields, electrical fields, and electrical charges.

4.03.01.03 Identify and describe basic electrical systems components and theories.

*4.03.02.00 Using measuring and mathematical techniques, apply the laws of motion and conservation to real physical systems.

4.03.02.01 Describe energy transfers and transformations of a system utilizing conservation laws.

4.03.02.02 Describe motion in the context of Newton's Law: linear and rotational.

4.03.02.03 Define work and energy and relate these concepts to kinetic energy, potential energy, and conservation of energy.

4.03.02.04 Define temperature and heat in units commonly used for each.

4.03.02.05 Identify the causes and effects of motion.

4.03.02.06 Use vector analysis (mathematical and graphical) to represent and solve force system problems.

*4.03.03.00 Analyze the heat energy changes within a system as related to the laws of thermodynamics.

4.03.03.01 State first and second laws of thermodynamics.

4.03.03.02 Define specific heat capacity and latent heat.

4.03.03.03 Discuss the concept of entropy.

*4.03.04.00 Using the knowledge gained through experimentation of the characteristics of waves, predict how waves will behave as they interact with each other and various materials.

4.03.04.01 Describe sound systems, including the interaction of matter and energy and energy transformation.

4.03.04.02 Identify the general areas of the electromagnet ice spectrum.

4.03.04.03 Describe reflection and refraction as applied to mirrors and optical instruments (lenses).

4.03.04.04 Describe the particle and wave theories of light.

Laboratory Safety Procedures

*4.04.01.00 Identify and be able to manipulate lab apparatus and materials safely.

*4.04.02.00 Demonstrate familiarity with lab safety equipment (e.g., eyewash, fire blanket & extinguisher, shower, etc.).

Scientific Process

*4.05.01.00 Using sound experimental designs, formulate hypotheses and models that account for observable events.

4.05.01.01 Describe the role of observation and experimentation in the development of scientific theories.

4.05.01.02 Describe the importance of the use of models in scientific thought.

4.05.01.03 Recognize that scientific models are only representations of phenomena and may in fact be faulty or deficient.

4.05.01.04 Investigate some of the ethical dilemmas of the scientist.

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4.05.01.05 Identify and define a scientific problem.

4.05.01.06 Ask appropriate scientific questions and recognize what is involved in experimental approaches to the solutions of such questions through familiarity with laboratory and field work.

4.05.01.07 Identify problems rooted in science and technology (effects of hazardous materials on health and safety, effects of drugs on health, troubleshooting problems on a machine).

*4.05.02.00 Use sound experimental designs and models to test hypotheses.

4.05.02.01 Distinguish among fact, hypothesis, and opinion; the relevant from the irrelevant; and the model from the observations the model was derived to describe.

4.05.02.02 Check the logical consistency of hypothesis with relevant laws, facts, observations, or experiments.

4.05.02.03 Read scientific materials critically.

4.05.02.04 Gather scientific information through library work.

4.05.02.05 Investigate areas of specialization in science.

4.05.02.06 Apply basic scientific/technical solutions to selected problems.

4.05.02.07 Employ scientific laws and principles in familiar or unfamiliar situations.

4.05.02.08 Make predictions from data using concepts, laws, and theories.

4.05.02.09 Use facts, concepts, laws, and theories to explain phenomena.

4.05.02.10 Predict the effects of changing variables in a given situation.

4.05.02.11 Suggest or recognize a scientific hypothesis.

4.05.02.12 Construct a hypothetical model.

4.05.02.13 Make direct measurements using laboratory apparatus.

4.05.02.14 Design, conduct, and evaluate an experiment.

4.05.02.15 Use sampling techniques.

4.05.02.16 Propose or select validating procedures (both logical and empirical).

4.05.02.17 Analyze experimental designs.

4.05.02.18 Demonstrate concern for issues related to measurement (e.g., reliability and validity).

•4.05.03.00 Using observations derived from experimental data, draw conclusions or make inferences.

4.05.03.01 Interpret data; i.e., comprehend the meaning of data and recognize, formulate, and evaluate conclusions and generalizations on the basis of information known or given.

4.05.03.02 Interpret information presented in pictures, drawings, charts, graphs, mathematical expressions, and scientific literature.

4.05.03.03 Reason quantitatively and symbolically.

4.05.03.04 Interpret observations of experiments and analyze these to determine patterns, state inferences, and/or draw conclusions.

4.05.03.05 Interpret experimental observations using facts, concepts, laws, and theories.

•4.05.04.00 Organize and communicate the results obtained by observation and experimentation.

4.05.04.01 Sequence events according to the order of occurrence.

4.05.04.02 Describe ways scientists communicate their results.

4.05.04.03 Demonstrate the ability to summarize empirical findings clearly and concisely in written form.

SOCIAL/CULTURAL LITERACY

Growth of Social Political, and Economic Institutions

*5.01.01.00 Describe the role of individuals within their political system, process of voter registration, the election process and responsibility and privileges of citizenship and how law protects individuals.

*5.01.02.00 Explain reasons for European settlement in the New World, the development of divergent political ideology and development of a new nation.

*5.01.03.00 Examine important historical documents in context with the American experience including socio-political and ideological influences that shaped their design. (NW Ordinance, Declaration of Independence, Bill of Rights, and Constitution)

  5.01.03.01 Explain the purpose and contents of the Bill of Rights.

  5.01.03.02 Demonstrate an understanding of federalism (local, state, national).

  5.01.03.03 Identify the main function of each branch (legislative, executive, judicial) at different levels.

  5.01.03.04 Describe the process for making, amending or removing laws.

  5.01.03.05 Identify representative symbols: flag, national anthem, Pledge of Allegiance, Independence Day, etc.

*5.01.04.00 Describe the political process.

  5.01.04.01 Understand the role of political parties in a democracy.

  5.01.04.02 Understand the role of public officials and how policy is carried out.

  5.01.04.03 Describe strengths and weaknesses of the American System.

  5.01.04.04 Describe how resources are gathered to support the process and policies.

*5.01.05.00 Compare and contrast political systems.

  5.01.05.01 Distinguish characteristics and essential features of representative democracy, monarchy, and dictatorships.

5.01.05.02 Identify international governing bodies (e.g., United Nations, League of Nations, World Bank, European Economic Community, Organization of American States, etc.) and their impact.

*5.01.06.00 Compare the culture, customs, and traditions of different ethnic and minority groups in America.

5.01.06.01 Be aware of the diverse social, psychological, political, and economic factors which influence lifestyles.

5.01.06.02 Evaluate methods and procedures applied by individuals, groups and social agencies to overcome social and economic barriers.

5.01.06.03 Determine the role of, and conflict between, American values such as order, freedom, equality and individualism as they operate in the American Political System.

5.01.06.04 Assess the impact of social class and social structure on economic development in specific countries in the First World and in the Third World.

*5.01.07.00 Know that individuals and societies make choices to satisfy wants with limited resources.

5.01.07.01 Develop an understanding of economic systems.

5.01.07.02 Develop an understanding of the structure and functions of the American economy.

5.01.07.03 Recognize the uneven distribution of world resources.

5.01.07.04 Describe the role of technological growth in economic development and the impact of technology on the physical and human environment.

Human Diversity and Historical/Current Issues

*5.02.01.00 Describe the causes and effects of selected wars.

*5.02.02.00 Describe the diversity of populations encompassing the Civil Rights movement, racism, ethnocentrism, and minority group movements.

5.02.02.01 Recognize diversity among significant individuals

5.02.02.02 Recognize diversity among significant organizations

5.02.02.03 Recognize diversity surrounding immigration

5.02.02.04 Recognize diverse ethnic and minority groups

5.02.02.05 Recognize major world religions

5.02.02.06 Describe the relationship between diversity and historical development and contributions

*5.02.03.00 Describe how an individual interacts with the various societal, economic, and political systems.

5.02.03.01 Be aware of the diverse social, psychological, political and economic factors which influence lifestyles.

5.02.03.02 Recognize individuals and societal practices which result in exceptional treatment of people from various backgrounds.

5.02.03.03 Identify and define the basic concepts of community and community development, and the role of individuals within their political systems and opportunities for civic involvement.

5.02.03.04 Describe and discuss contemporary domestic and international political issues and events, and evaluate the way they impact on self and society.

5.02.03.05 Identify and discuss career opportunities.

Analyzing Information

*5.03.01.00 Differentiate between primary and secondary sources of information.

*5.03.02.00 Illustrate that information can be influenced by cultural bias or propaganda.

*5.03.03.00 Analyze and explain social, cultural and political problems and suggest remedies to those problems.

*5.03.04.00 Compare and contrast culture, customs and traditions of ethnic and minority groups.

*5.03.05.00 Analyze social forces that influence family life.

*5.03.06.00 Demonstrate the ability to use information that enables citizens to make informed choices.

*5.03.07.00 Communicate and cooperate with people of different cultural backgrounds.

*5.03.08.00 Collect and analyze information from charts, graphs, maps, and pictures.

*5.03.09.00 Identify and explain how world problems and future trends will impact his or her life.

*5.03.10.00 Describe and discuss world patterns of population, geographic landforms, climate regions, and economic activities.

*5.03.11.00 Identify opportunities for involvement in civic activities.

TECHNOLOGY LITERACY

Impact of Technology

*6.01.01.00 Develop an awareness of the need and function of technology in society.

- 6.01.01.01 Explore cause and effect linkages between technology and the environment.
- 6.01.01.02 Explain how technological change can affect all technology.
- 6.01.01.03 Evaluate the impact of technology on people, the environment, culture, the economy, and community.
- 6.01.01.04 Explain how business and industry are related to the larger context of technology, industry, and society.
- 6.01.01.05 Describe the way in which technological systems have affected social changes and patterns in our society.
- 6.01.01.06 Explore how people use technology to solve problems.

*6.01.02.00 Develop an awareness of the significance of technology in the past, present, and future.

*6.01.03.00 Explain the interrelationships between business, industry, and society.

- 6.01.03.01 Evaluate the impact of infrastructure deterioration on people, the environment, and the economy.

*6.01.04.00 Analyze the role of ethics in technological decision making.

- 6.01.04.01 Research the social effects of technology and identify ethical implications that develop.
- 6.01.04.02 Recognize that all technological endeavors yield positive and negative side effects.
- 6.01.04.03 Describe the impact of government on the use of technology.
- 6.01.04.04 Describe copyright laws and issues as they apply to software.
- 6.01.04.05 Describe security/privacy issues related to the use of computers.

*6.01.05.00 Explain the interrelationship between business, industry, and community.

Technology in the Workplace

*6.02.01.00 Describe the importance of product quality control.

- 6.02.01.01 Participate in project-oriented quality control exercises.

*6.02.02.00 Describe the importance of the quality control process.

- 6.02.02.01 Explain how improved quality leads to improved productivity, competitive position, and profitability.
- 6.02.02.02 Define the principles of team management.
- 6.02.02.03 Describe the importance of statistical process control.
- 6.02.02.04 Plan team meetings.
- 6.02.02.05 Cite examples of companies that have benefitted from quality efforts.

*6.02.03.00 Solve problems utilizing a systems approach.

- 6.02.03.01 Apply brainstorming as a method for generating ideas.
- 6.02.03.02 Apply cause and effect analysis.
- 6.02.03.03 Evaluate results and make modification to improve a solution.
- 6.02.03.04 Compile and analyze experimental or design data.
- 6.02.03.05 Seek new knowledge, synthesize this information, and formulate it into a report or use it in solving a defined problem.
- 6.02.03.06 Use a research and development process common to industry to solve problems (integrating a variety of productivity analysis skills).
- 6.02.03.07 Learn how to reach a group consensus.
- 6.02.03.08 Distinguish between open and closed loop systems.

*6.02.04.00 Define productivity and its relationship to management concepts.

- 6.02.04.01 Develop an action plan that details what, when, and by whom, action will be taken for performance improvement.
- 6.02.04.02 Demonstrate the ability to apply management and planning tools such as flow charts, check sheets, cause and effect diagrams, control charts, etc.
- 6.02.04.03 Describe and use the Plan-Do-Check-Act process.
- 6.02.04.04 Describe input, process, output systems.

*6.02.05.00 Given an industry or a company, identify "customers."

*6.02.06.00 Develop the ability to function as a member of small or large groups.

- 6.02.06.01 Learn how to reach a group consensus.
- 6.02.06.02 Participate in at least one decision-making responsibility role of a hypothetical enterprise.
- 6.02.06.03 Demonstrate effective negotiation skills.
- 6.02.06.04 Demonstrate effective delegation skills.
- 6.02.06.05 Describe the purpose of unions.

*6.02.07.00 Describe the free enterprise system.

- 6.02.07.01 Describe a simplified version of a patent application process to ensure protection of ideas and control of disclosure.

Technological Tools and Techniques

*6.03.01.00 Describe basic computer operations.

*6.03.02.00 Operate computer hardware.

- 6.03.02.01 Demonstrate keyboarding proficiency.
- 6.03.02.02 Demonstrate the ability to utilize various peripherals.
- 6.03.02.03 Access information networks of a variety of types.

6.03.02.04 Identify and describe the function of the major hardware components comprising a personal computer.

*6.03.03.00 Utilize a variety of software.

6.03.03.01 Prepare reports, resumes, or memoranda using a word processing package.

6.03.03.02 Describe what a database is and what it is used for.

6.03.03.03 Demonstrate general knowledge of CAD and CAM technologies.

6.03.03.04 Describe the major types and applications of software.

6.03.03.05 Determine the availability of resources through information networks.

6.03.03.06 Operate desktop publishing systems.

6.03.03.07 Access external computers using a modem.

6.03.03.08 Utilize information management systems.

6.03.03.09 Utilize a spreadsheet package.

6.03.03.10 Apply basic commands to format disks, copy files, create directories, delete files, change default drives, and access software packages for a variety of computer systems.

*6.03.04.00 Use basic technological language accurately across a variety of technologies.

6.03.04.01 Demonstrate familiarity with different types of language forms used in various technologies, i.e., graphic, symbolic, and verbal.

6.03.04.02 Recognize that different technologies use jargon specific to those technologies.

6.03.04.03 Describe the resources necessary for technology resource people: i.e., information, materials, tools/machines, capital, energy, and time.

*6.03.05.00 Visualize and describe two- and three-dimensional space.

6.03.05.01 Demonstrate familiarity with the basic types of engineering drawings.

6.03.05.02 Illustrate and/or describe 3-D objects from different points of view (front, back, side, etc.)

6.03.05.03 Develop a three-dimensional mental and physical representation of an object from a two-dimensional drawing.

6.03.05.04 Visualize and present product ideas

*6.03.06.00 Utilize two- and three-dimensional drawings.

6.03.06.01 Represent a three-dimensional object in a two-dimensional drawing.

6.03.06.02 Refine and communicate project ideas.

*6.03.07.00 Create a three-dimensional drawing.

*6.03.08.00 Develop responsible attitudes toward safety around technology.

6.03.08.01 Demonstrate the safe and correct handling of hazardous materials and processes.

6.03.08.02 Demonstrate proper use of common hand and power tools.

*6.03.09.00 Use measuring devices.

6.03.09.01 Perform linear measuring procedures.

6.03.09.02 Perform volume measuring procedures.

6.03.09.03 Demonstrate the accurate use of architectural and engineering scales.

6.03.09.04 Perform temperature measuring procedures.

*6.03.10.00 Demonstrate factors affecting the selection and use of material resources.

6.03.10.01 Explore the utilization of tools and materials in engineering applications.

6.03.10.02 Describe the major properties of materials.

6.03.10.03 Safely perform some common secondary materials processing activities (e.g., drilling, milling, turning, and grinding).

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*6.03.11.00 Choose appropriate resources.

  6.03.11.01 Perform selected tests to determine materials properties and appropriateness for various uses.

*6.03.12.00 Use multimedia equipment.

  6.03.12.01 Create multimedia presentations.

*6.03.13.00 Demonstrate an understanding of the roles and importance of electronics in contemporary technology

  6.03.13.01 Describe what is meant by electronics technology.

  6.03.13.02 List where electronics technology is used.

  6.03.13.03 Describe why electronics technology is used.

HEART of OHIO TECH PREP CONSORTIUM
1997

Environmental Technology Model

PART III:
Tech Prep Secondary Competencies (Leveled)

(New Albany High School - Eastland VEPD Satellite)

Completed - will forward later

HEART of OHIO TECH PREP CONSORTIUM

1997

Environmental Technology Model

PART IV:
Postsecondary Competencies

Columbus State Community College

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Columbus State Community College
Assessment Matrix - ENVIRONMENTAL TECHNOLOGY

Revised 6/28/97

STUDENT OUTCOMES	ENGL101	MATH112	ENVR101	GEOL101	ENVR158	ENGL102	ENVR110	BIO 111	ENVR130	COMM110	CHEM111	SURV141	ENVR120	BIO127	MATH135	ENVR253	ENGL204	ENVR250	ENVR220	CIVL221	SSCI104	ENVR255	ENVR112	ENVR254	HUM152	ENVR224	ARCH111	CIVL223	ENVR223	ENVR290	ENVR291	MULT102	MULT103	ENVR256	MECH111
1. Compile data and perform data manipulation and reporting tasks using a word processor, spreadsheet, and graphics.		F													F							F	S								F				
2. Assist the engineer in preparing reports using technical writing skills.	F		F		S	F				F							S						F						F		S				F
3. Collect air, water, waste, and soil samples for routine monitoring as required by regulatory agencies.			F	F			F		F		F		F	F		F		S	F	F		S		S		F			F		F	F	F	F	
4. Review toxic or hazardous waste studies to provide information for compliance with environmental standards.			F	F				F	S		F		F	F	F			F	F					F					F					F	
5. Assist in the operation and maintenance of systems used to control pollution at the source as required by environmental laws.							F			F						S				F		F						S	S		F				F
6. Perform duties related to the management, storage, disposal, and emergency response to spills of hazardous materials and toxic substances in accordance with OSHA health and safety requirements.			F						F		F							F						F					F		F	F	F	F	
7. Collect and compile data necessary for an environmental site assessment.					S					F		F	F		F			F	F			F	F	F		F	F		F		F			F	
8. Utilize basic concepts of geology and hydrology in summarizing data to be used in analyzing the environmental fate and transport of hazardous substances.			F	F									F						F	F						S									
9. Conduct field investigations using environmental instrumentation.		F	F	F				F			F		F	F				S	F			S		S		F					F	F	F	F	
10. Understand basic risk assessment and toxic substances exposure analysis techniques.			F	F				F			F		F	F					F															F	
11. Understand duties requiring knowledge of industrial hygiene in hazardous materials, including OSHA legislation.			F					F	F		F			F				F	F										F					F	
12. Think critically.	F	F/S	F	F		F	F							F	F/S		F				F										F	F	F		
13. Solve problems.		F/S	F	F			F				F			F	F/S			F			F							F			F	F	F		
14. Communicate effectively.	F	F	F			F				F/S					F		F/S				F		F		F					F	F				
15. Demonstrate interpersonal skills.																					F/S				F/S					F	F	F	F		
16. Recognize the value of human diversity.								F													F/S				F/S						F				
17. Demonstrate life management skills.		F																												F	F				

F = FORMATIVE ASSESSMENT
S = SUMMATIVE ASSESSMENT

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Environmental Technology
Methods of Formative and Summative Assessment

Student Outcome	Methods of Formative Assessment	Methods of Summative Assessment
1. Compile data and perform data manipulation and reporting tasks using a word processor, spreadsheet, and graphics	Lab performance, tests and quizzes In class assignments	Lab performance Exam
2. Assist the engineer in preparing reports using technical writing skills	Project reports Class assignments Tests and quizzes Take home assignments.	Exam Project reports
3. Collect air, water, waste, and soil samples for routine monitoring as required by regulatory agencies.	Lab performance Tests and quizzes Project submittal	Exams Lab performance
4. Review toxic or hazardous waste studies to provide information for compliance with environmental standards	Tests and quizzes Project submittal Class assignments	Exams
5. Assist in the operation and maintenance of systems used to control pollution at the source as required by environmental laws.	Project submittal Texts and quizzes Lab performance	Lab performance Exams
6. Perform duties related to the management, storage, disposal, and emergency response to spills of hazardous materials and toxic substances in accordance with OSHA health and safety requirements.	Lab performance In class assignments	Exam Lab performance Final lab practicum

Student Outcome	Methods of Formative Assessment	Methods of Summative Assessment
7. Collect and compile data necessary for an environmental site assessment.	Project submittal Take home assignment Tests and quizzes Lab performance	Exams Major project
8. Utilize basic concepts of geology and hydrology in summarizing data to be used in analyzing the environmental fate and transport of hazardous substances	Tests and quizzes Lab performance In class assignments Identification labs	Exams Lab performance
9. Conduct field investigations using environmental instrumentation	Lab performance Tests and quizzes	Lab performance Exams Lab practicum
10. Understand basic risk assessment and toxic substances exposure analysis techniques	Lab performance Tests and quizzes	Exams
11. Familiarity with duties requiring knowledge of industrial hygiene in hazardous materials, including OSHA legislation.	Tests and quizzes In class assignments	Exams -
12. Think critically.	Planning, selecting correct equipment, applying industry standard procedures, and executing laboratory assignments. Troubleshooting equipment exercises in laboratory. Written examinations	Simulated and actual problems to analyze and solve. Team project performance. Exam.
13. Solve problems	Written laboratory, research, and homework exercises. Written examination. Project simulations In class presentations	Simulated and actual problems to analyze and solve Exam Laboratory performance

Student Outcome	Methods of Formative Assessment	Methods of Summative Assessment
14. Communicate effectively	Discussion groups Class participation through the use of oral communications Group research and presentation projects Written communication exercises	Project coordination with team Exam using short answer, and essay questions. Individual and team performance in making presentations
15. Demonstrate interpersonal skills	Group research and Presentation projects Group discussions	Exam Team project assignment
16. Recognize the value of human diversity	Group discussions Team research and presentation projects with diverse team members	Exam Team members dependent on each other for success
17. Demonstrate life management skills	Team leaders and group members working on various class projects Deadlines Performance responsibilities	Project assignment requiring systematic orderly approach at management

ENVIRONMENTAL DEPARTMENT

METHODS USED FOR SUMMATIVE STUDENT ACHIEVEMENT

- Employers participating in the ENVR 291 - Summer Field Coop Experience program submit reports evaluating the student's ability to perform specific job functions (related to program outcomes).
- Annual Graduate Follow-Up Surveys conducted by Research and Planning.
- Annual Employer Follow-Up Surveys conducted by Research and Planning.
- Informal discussions with employers to determine what graduate/student skill levels are and where additional training/education are needed.
- Informal discussions with graduates to determine what skills they use on the job and what additional skills should be taught.

HEART of OHIO TECH PREP CONSORTIUM

1997

Environmental Technology Model

PART V:
Labor Market Data

TABLE 1

LABOR MARKET PROJECTIONS FOR PROPOSED TECH PREP MODEL CAREER CLUSTERS 1991-2000*

OCCUPATIONAL AREA	ANNUAL RATE OF CHANGE (%)		TOTAL ANNUAL OPENINGS	
	OHIO	SDA 16	OHIO	SDA 16
Multi-Competency Health Technology				
Nurse Aide	2.7	2.6	2609	362
Home Health Aide	4.0	4.7	516	90
All other	2.4	2.6	357	66
Civil Engineering Technology				
Civil Construction Manager	1.5	1.9	128	26
Surveyor	1.0	1.3	38	8
Drafter	1.1	1.5	769	128
Environmental Technology				
Plant/System Operations	0.1	0.5	360	46
Physical/Life Sciences Technician	0.7	1.2	276	44
Construction Management Technology				
Construction Manager	0.8	0.7	119	29
Graphic Communications Technology				
Graphic Designer	2.1	2.1	607	54
Photographer	0.9	1.8	181	31
Technical Communications Technology				
Technical Writer	1.3	2.3	68	11
Editor	1.8	1.8	247	39

*Ohio Bureau of Employment Services, 1991-2000 Labor Market Projections.

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Environmental Technology Model

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HEART of OHIO TECH PREP CONSORTIUM
1997

Environmental Technology Model

PART VII:
Program Application

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TECH PREP PROGRAM APPLICATION

Tech Prep Consortium Heart of Ohio Tech Prep Consortium Date 1996

Proposed Tech Prep Program Environmental Technologies

1. Provide labor market information substantiating employment opportunities in your area.

Program approved per FY 1996 proposal for operating funds. Labor market data included the following excerpt from the Ohio Bureau of Employment Services, 1991-2000 Labor Market Projections:

OCCUPATIONAL AREA	ANNUAL RATE OF CHANGE (%		TOTAL ANNUAL OPENINGS	
	OHIO	SDA 16	OHIO	SDA 16
Environmental Technology				
Plant/System Operations	0.1	0.5	360	46
Physical/Life Sciences Technician	0.7	1.2	276	44

2. List the potential associate degree/apprenticeship exit occupations for this Tech Prep program.

Hazardous Waste Technician
Plant/System Operations Technician
Physical/Life Sciences Technician
Air Sampling & Monitoring Technician
Field Sampling Technician
Chem/Analytical Lab Technician
Environmental Compliance Technician
Emergency Spill Response Technician
Haz Mat Technician
Water Plant Operator
Asbestos Abatement Worker/Supervisor/Inspector
Lead-based Paint Abatement Worker/Supervisor/Inspector

Environmental Technician
Wastewater Analyst
Water Analyst
Soil Analyst
Hazardous Materials Analyst
Biological/Microbiological Lab Technician
Decontamination Technician
Leaking Underground Storage Tank Remover
Wastewater Plant Operator

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3. List the potential high school exit occupations for this Tech Prep program.

Wastewater Treatment Plant Operator
Environmental Lab Technician
Water Plant Operator
Natural Resources Aide
Pollution Control Technician

4. Describe your consortium's plan for delivery of this Tech Prep program.

Eastland VEPD opened a satellite program at New Albany High School at grade 11 in school year 1996-97 as a vocationally funded unit. The program is open to students from any of Eastland's 16 associate districts. In addition, an agreement with Westerville City Schools (outside the Eastland VEPD but geographically contiguous) has enabled students from that district to enroll in the program at New Albany High School. The New Albany site has immediate access to a wetlands area on the school campus and another contiguous to the campus for use as an outdoor laboratory for the program.

At this time, Columbus State Community College is the only postsecondary partner offering a Tech Prep college pathway to complete this model. The college will enable the Tech Prep high school to receive college credit for competency areas they have mastered; students will be strongly encouraged to complete the entire Tech Prep college pathway of their choice, which includes advanced skills coursework.

The Consortium has distributed copies of the program model to all partner schools and colleges. Schools that currently do not offer the model have been encouraged to consider doing so, and Pickaway-Ross VEPD and Ohio University-Chillicothe have taken this under study.

The model will be reviewed annually at the local level, and every three years by the Consortium's Program Advisory Committee for the model.